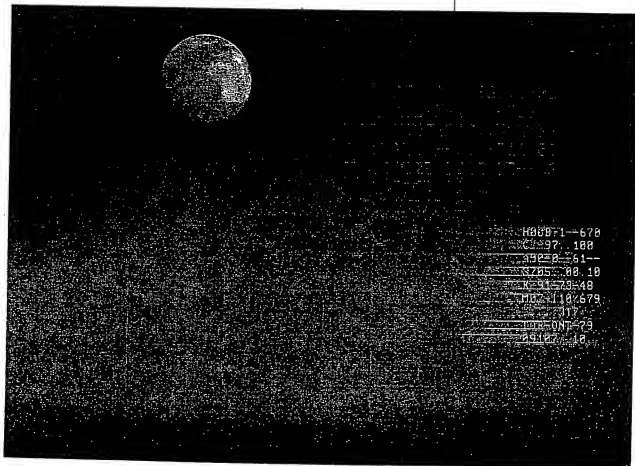


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Cantel Mobitex

Data communications
for people on the move™

CANTEL



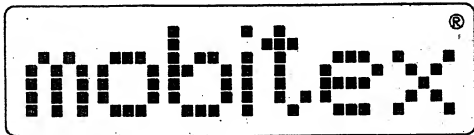
MOBILEX
TERMINAL SPECIFICATION
900 MHz 8000 bps

ROGERS CANTEL MOBILE INC

Terminal type 3
LZHA 703-1001705

BIA

CANTEL



TERMINAL SPECIFICATION

Approved by
MOBITEX OPERATORS ASSOCIATION

Jen-Olof Runnäs
Jen-Olof Runnäs, Chairman

Cantel Mobitex™

Doc No.		
System Name	1 Rev	PC File

SPECIFICATION
FOR
EQUIPMENT TO BE USED WITH
CANTEL MOBITEK
RADIO DATA NETWORK
ISSUE R1A
8000 bps

Rogers Cantel Mobile Inc.
Data Communications Division
40 Eglinton Ave. East
Toronto, Ontario
M4P 3A2
Canada

Registration Number: _____

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Rev. 2/84

System Name

1 Rev

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1. MOBITEX OVERVIEW

The Cantel Mobitex system is a trunked land based communications system designed to carry data traffic between fixed and mobile terminals. The Mobitex System consists of a Network and a collection of subscribers. The Network is a common carrier which transports information packages (packets). The subscribers are customers who have contracted with Cantel the Mobitex network operator to use the network services. Each subscriber must own, lease, or otherwise have access to a terminal through which he or she can transmit and receive messages. The contract between the subscriber and Cantel is referred to as a subscription.

This specification is intended to provide a description of the Mobitex system in Canada, sufficient to permit understanding of the system operation and terminal requirements, so that engineers, software designers, and manufacturers can design, manufacture, and test equipment which may be developed and sold as subscriber terminals in the Cantel Mobitex system.

While this specification has been developed for the design and manufacture of terminals for use in Canada, it also provides limited comments on the differences between Canadian and the US Mobitex systems, for the benefit of any manufacturers who wish to develop Mobitex terminals which are compatible for use throughout North America.

The applications of Mobitex to commerce are limited only by the creativity of the subscribers. The more common expected uses are:

1. Dispatch traffic, consisting of brief messages from a dispatcher in an office to mobile units in the field.
2. Requests for information or instructions from field operators to superiors and replies to such requests.
3. Data base access, where there is need to obtain information from a computer.
4. Data transfer, as between a computer in a vehicle and a computer in an office or data processing center.
5. Resource monitoring, such as keeping track of field staff and the completion of field tasks to aid in the efficient further dispatching or recall of personnel and equipment.
6. Resource control, such as the remote controlling of power plants, heating and air conditioning systems, processing facilities, etc., in remote or rural areas where wireline facilities are unavailable and expensive to install.
7. Fixed or mobile remote data gathering devices.

Subscribers

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As seen from this list, communications may be between people, between a person and a machine (including but not limited to computers), and between computers (including between a computer controlled machine and its controller). The electromagnetic spectrum through which radio communication is feasible is limited, and it is important that users of the spectrum use it efficiently. Data communication is inherently much more efficient in spectrum use than voice communication. It allows many more users to share a single radio channel for information transfer than does voice transmission. Cellular communication, in which a low power channel may be reused several times within a metropolitan area, is also more efficient in spectrum use than the higher power broadcast communications, in which a channel can only be used once in a metropolitan area, and requires large separation distances before channels can be reused. The Mobitex system combines the advantages and efficiencies of data communication and cellular networking to provide a highly efficient use of the radio spectrum for message communication.

The Mobitex system is complex, and this specification provides a requirements description to the extent necessary for equipment designers, manufacturers, and Mobitex customers to understand it and to permit development, manufacture, and proper use of Mobitex terminal equipment. Chapter 2 provides a brief system description of the Mobitex system. The subsequent chapters provide the details necessary for terminal equipment design.

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INTRODUCTION TO ISSUE NO. 1

This is Cantel's first issue of the 8K Mobitex Terminal Specification. It applies to fixed, mobile and portable terminals to be used with the Mobitex Network, which is installed and operated by Rogers Cantel Mobile Inc. in Canada.

The major part of this document was prepared by ERITEL AB, a Swedish Company, under the auspices of the Mobitex Operators Association (MOA), which is a group of representatives from all countries that use the basic Mobitex System. It should be noted that equipment built to this specification will also operate on the Mobitex Network operated by RAM Mobile Data in the United States. This document also includes requirements for equipment that will operate with other networks.

For example, some networks are permitted to offer optional voice service over their Mobitex network, whereas in Canada and the United States, voice service is not offered. Therefore, requirements herein that apply to voice service are not applicable to terminals that will be sold for use on the Cantel Mobitex network. The voice requirements have been left in the specification so a manufacturer can consider designing a common product for sale in Canada, or elsewhere.

This document is divided into chapters. Chapter 1 is an Introduction to the specification. Chapter 2 is an overview of the Mobitex system. Chapter 3 includes a general discussion of terminals. Chapter 4 includes a glossary of terminology and acronyms. Chapter 5 includes a list of references. The following chapters include the design requirements for each subunit of the terminal product(s):

1. For a fixed terminal
 - Chapter 8 - Application Layer
 - Chapter 9 - Network Layer
 - Chapter 11 - Link Layer and Physical Layer
 - Chapter 12 - Other Requirements
2. For the mobile radio
 - Chapter 18 - Radio Equipment
 - Chapter 20 - Other Requirements
3. For the mobile and portable modem/radio controller
 - Chapter 9 - (Appendix C) - Network Layer
 - Chapter 15 - Draft Hand-held Portable Protocol
 - Chapter 16 - Link Layer
 - Chapter 17 - Physical Layer
 - Chapter 19 - Other Interfaces
 - Chapter 20 - Other Requirements

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Cantel Mobitex

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Chapter 6 includes all requirements not recorded elsewhere that are applicable to the use of terminals in Canada.

A manufacturer has the option of designing and supplying fixed terminals and/or mobile terminals. The latter can be broken down into the radio, modem/controller, and user terminal. Therefore, a manufacturer can elect to provide a total assembly of all three parts, a radio, a modem/controller, or a terminal, or any applicable combination of the above.

To facilitate interconnection of mobile terminal components from various manufacturers, and to permit standardization of vehicle cabling, specific electro/mechanical interfaces are defined herein for each component.

If a manufacturer elects to design a combined radio modem in one housing, the interface specified herein would not apply. Likewise, if a manufacturer elects to manufacture a totally integrated radio/modem terminal, such as a hand held unit, the interfaces herein need not apply.

All questions or comments related to this Cantel-version of the Mobitex specification should be sent to Cantel. The address is:

Terminal Specifications Inquiries
Rogers Cantel Mobile Inc.
Data Communications Division
40 Eglinton Ave. East
Toronto, Ontario
Canada
M4P 3A2

Phone: (416) 440 1400
Fax: (416) 480 9069

Numbered copies of this specification will be issued on request to the above. Revision material will be periodically issued and sent to each registered holder of the specification.

Transfer of a numbered specification within a company should be reported to Cantel at the above address so revision material will be sent to the proper person. Copies made of this specification must be internally controlled since revision material will only be sent to registered holders of the specification. Copies may not be distributed outside the organization to which the specification was originally issued.

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Cantel Mobitex™

No. 34		
Version: 3.0a	1 Rev	PL 7.0

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SIGNIFICANT CHANGES FROM SPECIFICATIONS R4B:

1. "Transferable subscriptions" have been renamed "Personal subscriptions" (Sect. 3.1.2).
2. Emergency traffic is not restricted to origination from mobile terminals (Sect. 3.2.3).
3. A "network identification" has been added to accommodate joint traffic where multiple networks exist (Sect. 3.3.12).
4. A "traffic area identification" has been added to specify geographical areas for mobile control (Sect. 3.3.13).
5. The time limit before transmit of an "active" message after loss of network contact in Sect. 7.1.2 has been changed and is specified in R1-06.
6. An electronic serial number is now required on all mobile terminals (Sect. 8.2.6).
7. References to a "National System Channel" have been replaced by "System Channel" to reflect the fact that system channels may vary by geographical area. (Sect. 9.1.2).
8. All references to VOICE services may be ignored.
9. An appendix has been added to this section. It contains an overview of the new roaming algorithm to be used in the 8000 bps Mobitex system.
10. Section 15, Protocol for hand-held terminals has been added.

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Datum - Date 1989-05-19 A	General description of terminals	3
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001 53 - 02/LZBA 703 1001	Arrangement of the documents 1
Guided - Approved ET/UC Gim G ₁₉₈₉	MOBITEX system description 2
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Project Name ET/SYS M0t	Parenting Volume Number ET/SYS M0t	No. No 001 51 - LZBA 703 1001/05 Ue
Parenting Code ET/SYSC STT SY	Order Date 1990-02-26	Rev B
Description Cantel Mobitex		File No MTSOLA.5
<p>MOBITEX TERMINAL SPECIFICATION Fixed and mobile terminals</p>		
<p>This set of documents, entitled "MOBITEX TERMINAL SPECIFICATION" applies to:</p> <p>MOBITEX system: Cantel Inc, Canada Fixed and mobile terminals</p> <p>Terminal type: 3 900 MHz/8 kbps</p> <p>Binder identification: LZBA 703 1001/05, R1A</p>		
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Section 3: General description terminals	1056 - A 296 5170 Ue	B
Section 4: Terminology	0033 - LZBA 703 1001 Ue	E
Section 5: References	0015 - LZBA 703 1001 Ue	E
Section 6: Network operator documents		
Section 8: Application layers	2/1056 - A 296 5171 Ue	G
Section 9: Network Layer	5/1056 - A 296 5171/2 Ue	A
Appendix A, Packet formats	51/1056 - A 296 5171/2 Ue	A
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 Date: 1990-02-26 Rev: B File: MTS01A.5

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BSC interface, fixed terminal	1056 - A 296 5490 Ue	C
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Asynchronous terminals, MPAD	1056 - A 296 5454 Ue	C
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Other requirements, fixed terminal	1056 - A 296 5176 Ue	C

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Section	Document number	Rev
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Section 17:		
Physical layer, mobile terminals	10/1056 - A 296 5171/02 Ue	A
Section 18:		
Radio equipment, mobile terminals	1056 - A 296 5173/04 Ue	A
Appendix A, Measurement methods	A/1056 - A 296 5173/01 Ue	C
Section 19:		
Other interfaces, mobile and fixed terminals	1056 - A 296 5175/3 Ue	A
Appendix A, Commands	2/1056 - A 296 5175/2 Ue	A
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General requirements, mobile terminals	1056 - A 296 5177/02 Ue	A

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Document Number	Document Title	Date	Rev
ET/SYSC STT STI		1990-02-26	B
Revision	Title		
	MOBITEX TERMINAL SPECIFICATION Fixed terminals		

Cantel Mobitex

This set of documents, entitled "MOBITEX TERMINAL SPECIFICATION" applies to:

MOBITEX system: Cantel Inc, Canada
Fixed terminals

Terminal type: 3
900 MHz/8 kbps

Binder identification: 01/LZBA 703 1001/05, R1A

COMMON SECTIONS:

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<u>Section 3:</u> General description terminals	1056 - A 296 5170 Ue	B
<u>Section 4:</u> Terminology	0033 - LZBA 703 1001 Ue	E
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FIXED TERMINAL SECTIONS:

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BSC interface, fixed terminal	1056 - A 296 5490 Ue	C
MASC interface, fixed terminal	1056 - A 296 5516 Ue	D
Asynchronous terminals, MPAD	1056 - A 296 5454 Ue	C

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Signature Required ET/SYS M0t	Facsimile Signature ET/SYS M0t	Doc No 001 51 - 02/LZBA 703 1001/05 Ue
Customer Code ET/SYSC STT <i>ST</i>	Doc Date 1990-02-26	Rev B
Title Canitel Mobitex™		File No MTS01C.5
Description MOBITEX TERMINAL SPECIFICATION Mobile terminals		
<p>This set of documents, entitled "MOBITEX TERMINAL SPECIFICATION" applies to:</p> <p>MOBITEX system: Canitel Inc, Canada Mobile terminals</p> <p>Terminal type: 3 900 MHz/8 kbps</p> <p>Binder identification: 02/LZBA 703 1001/05, R1A</p>		
<u>COMMON SECTIONS:</u>		
Section	Document number	Rev
Caption List	001 53 - 02/LZBA 703 1001 Ue	A
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<u>Section 2:</u> System description MOBITEX	1551 - A 296 5073 Ue	J
<u>Section 3:</u> General description terminals	1056 - A 296 5170 Ue	B
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<u>Section 5:</u> References	0015 - LZBA 703 1001 Ue	E
<u>Section 6:</u> Network operator documents		
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Dr. S. 001 51 - 02/ZBA 703 1001/05
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Appendix A, Frames	91/1056 - A 296 5171/A2 Ue	A
<u>Section 10:</u>		
Physical layer, mobile terminals	10/1056 - A 296 5171/02 Ue	A
<u>Section 11:</u>		
Radio equipment, mobile terminals	1056 - A 296 5173/04 Ue	A
Appendix A, Measurement methods	A/1056 - A 296 5173/D1 Ue	C
<u>Section 12:</u>		
Other interfaces, mobile and fixed terminals	1056 - A 296 5175/3 Ue	A
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<u>Section 13:</u>		
General requirements, mobile terminals	1056 - A 296 5177/02 Ue	A

Dr. S. 001 51 - 02/ZBA 703 1001/05

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DESCRIPTION

Rev. 0001
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Original Form ET/SYS M0t	Revised Form ET/SYS M0t	No. 1 1551 - LZBA 703 1001 Ue	
Document Control - Document approved ET/SYSC STP 5/1		Date Recd 1990-02-15 E	Rev. No. MTS01.1
Description Cantel Mobitex		Title MOBITEX Terminal specification Arrangement of documents	
<p><u>SUMMARY</u></p> <p>This document is an introduction to MOBITEX TERMINAL SPECIFICATION. The document explains the purpose of the specifications included, as well as how they are arranged.</p>			
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St. No.	1551 - LZBA 703 1001 Ue	
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Issue Date 1990-02-15	Rev. E MTS01.1

1 INTRODUCTION

This set of documents contains specifications and recommendations for fixed and mobile terminals to be connected to the MOBITEK network.

The purpose of the contents, is to define how a terminal is to function to be used in the MOBITEK network.

Terminals that should be connected to MOBITEK are tested in accordance with these specifications.

To every MOBITEK system, one or several unique binders of MOBITEK TERMINAL SPECIFICATION (MTS) is made up. The reader should observe, for which network and terminal type the specification is relevant.

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Sr. No.	1551 - LZBA 703 1001 Ue
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2 DOCUMENT ARRANGEMENTS

2.1 SECTION ORGANIZATION

The documents are divided into three main parts as shown below.

Common sections

Common documents both for fixed and mobile terminals, such as system descriptions, network operator information and protocols for higher layers.

Fixed terminal sections

Documents referring to fixed terminals, such as protocols and line interfaces.

Mobile terminal sections

Documents referring to mobile terminals, such as protocols and specifications for radio equipment.

The following chapters show the contents and the purpose of each section.

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No. 1551 - LZBA 703 1001 Ue			
<table border="1"> <tr> <td>Doc. Date 1990-02-15</td> <td>Rev. E</td> <td>File Name MTS01.1</td> </tr> </table>	Doc. Date 1990-02-15	Rev. E	File Name MTS01.1
Doc. Date 1990-02-15	Rev. E	File Name MTS01.1	

2.2 COMMON DOCUMENTS

Section Arrangement of the documents

Includes this document, and a document list which shows the document number and revision of all documents included in the present specification.

Section System description MOBITEK

The MOBITEK communication network is described in general. It is shown where the terminals are connected to the network, how the network is designed and where the interface between the network and the terminal is.

This section also describes the subscription types and services in the network.

Section General description of terminals

Provides a general description of the MOBITEK terminals, i.e. fixed and mobile terminals.

Section Terminology

Describes terms and abbreviations used in the specifications.

Section References

Gives a general illustration of the national and international documents referred to in this specification.

Section Network operator information

Consists of any type of network operator information. It could be related to both the network, such as bit rates for fixed terminals, frequency plans and network operator addresses etc.

This section completes the specification with information not given in the other sections. It is therefore important that the reader is familiar with the contents of this section.

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Section Application layer

Specifies the interface to the user of the terminals, i.e. how the terminal should support the subscriber when using the terminal.

The application layer interface to the lower layers is also specified.

Section Network layer

Specifies the structure of packets used by both the MOBITEX network and the terminals. It is also specified how packets are transmitted between the sender and the addressee.

As a guide line for implementation, a logical description of the network layer for mobile terminals is also included.

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No. No.		
1551 - LZBA 703 1001 Ue		
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1990-02-15	E	MES01.1

2.3 DOCUMENTS RELATED TO FIXED TERMINALS

Section Interface requirements, fixed terminal

Specifies the different types of line interface's for the link layer and physical layer, with connection procedure and frame sizes. The documents refers to a considerable degree to ISO standards.

Section Other interfaces, fixed terminal

See section "Other interfaces, mobile and fixed terminal".

Section Other requirements, fixed terminal

Contains requirements for the environment, power supply, marking control devices and indications.

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2.4 DOCUMENTS RELATED TO MOBILE TERMINALS

Section Link layer, mobile terminal

Specifies the radio interface's link layer with coding, frame structure, transmission of frames etc.

As a guide line for implementation, it also consists of a logical description.

Section Physical layer, mobile terminal

Specifies carrier wave modulation and conversion between digital data and analog signals.

As a guide line for implementation, it also consists of a logical description.

Section Radio equipment, mobile terminal

Contains requirements for the mobile terminal's radio equipment.

Section Other interfaces mobile and terminal

Provides recommendations of which protocol to be used for the interfaces between the mobile terminal's central unit and peripheral equipment such as printers, external operator units etc.

This recommendation is also used to show which protocol to be used for the interfaces between the mobile terminal's central unit and fixed terminals.

Section General requirements, mobile terminal

Contains requirements for the environment, power supply, marking, control devices and indicators.

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Cantel Mobitex

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Doc. File	MTS01.1

3 DOCUMENT ADMINISTRATION

This chapter will give the reader a brief idea of how to identify the included documents and how to use the internal references.

3.1 DOCUMENT IDENTIFICATION

Each individual document in the terminal specification has its own unique document number. This number is written at the top of each page to the right, in the field "No". This document, for example, has document number:

1551-LZBA 703 1001 Ue.

Below the document number is the printing date of the document, on the form year-month-day, and the current revision of the document.

Each document also got its own designation to be used in daily speech. This designation refers to the library section, and its version related to frequency, baud rate, function etc. The designation is placed under document identification number in the field "File".

The following format is used:

MTSNN.A.X

MTS	begins all designations (= <u>M</u> obitex <u>T</u> erminal <u>S</u> pecification)
NN	section number used in the binder, 1 - 20
A	appendix, A-Z (used when applicable))
X	version, 1 - n (related to frequency, baud rate, function etc.)

This document, for example, has document designation:

MTS01.1

On the next page, is the first version of each document listed. (Due to extended functionality new versions may have been made up.)

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Doc. No. 1551 - LZBA 703 1001 Ue
Doc. Date 1990-02-15 E Doc. File MTS01.1

<u>Designation</u>	<u>Document title / Binder section title</u>
MTS00.1	Caption list
MTS01.1	Arrangement of the documents Document list
MTS02.1	MOBITEX System description
MTS03.1	General description of terminals
MTS04.1	Terminology
MTS05.1	References
MTS06.1	Network operator documents
MTS08.1	Application layer
MTS09.1	Network layer
MTS09A.1	- " -, Packet formats
MTS09B.1	- " -, Dialogues
MTS09C.1	- " -, Logical description (8 kbps only)
MTS11HDL.1	Interface requirements, fixed term. - HDLC
MTS11X25.1	- " -, - X.25
MTS11BSC.1	- " -, - BSC
MTS11MASC.1	- " -, - MASC
MTS11MPAD.1	- " -, - MPAD
MTS12.1	Other requirements, fixed terminal
MTS16.1	Link layer, mobile terminal
MTS16A.1	Link layer, mobile terminal - Frames
MTS17.1	Physical layer, mobile terminal
MTS18.1	Mobile radio equipment
MTS18A.1	- " -, Measurement methods
MTS19.1	Other interfaces, mobile and fixed term.
MTS19A.1	- " -, Commands
MTS19B.1	- " -, Application example
MTS19C.1	- " -, Monitoring other channels than MOBITEX (1200 bps only)
MTS20.1	Other requirements, mobile terminal

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3.2 REFERENCES

On the last page of each document an index which shows all references made in the document and on which page(s) they are made.

The references are made on the form R1-nn, where nn refers to the section.

The reference designations used is also shown on the last page of the document.

3.3 SPECIFICATION SEPARATION

The terminal specification can be separated into two specifications, one for the mobile terminals and another for the fixed terminals. The common sections (1-9) are the same in both the specifications.

Below are the identification numbers of the binders when separated:

MOBITEX fixed terminal specification 01/LZBA 703 1001/nn

MOBITEX mobile terminal specification 02/LZBA 703 1001/nn

The suffix added after the identification number shows which network operator the specifications are intended for.

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DESCRIPTION

Doc. No. 1(38)

Document Prepared ET/SYS MÔt	Document Title - Subject Program ET/SYS GCn	Doc. No. 1551 - A 296 5073 Ue	
Document Checked - Doc. response approved ET/SYSC STT <i>STT</i>		Doc. Date 1990-02-19 J	Doc. File MTS02.1
Documenting Cantel Mobitex		Title Mobile radio communication system MOBITEX	

MOBITEX SYSTEM DESCRIPTION

ABSTRACT

This document gives a brief description of MOBITEX, a trunked land-based communication system, which is primarily designed for data and speech traffic between fixed and mobile terminals.

This description does not apply to any particular release of the system, and contains no requirements for implementation of terminal functions.

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Doc No. 1551 - A 296 5073 Ue
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MTS02.1

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1 INTRODUCTION

The major part of today's land mobile communication is of the dispatch type, i.e. communication between field personnel in mobile units and their dispatch centres. Most communication is in the form of speech. Each company normally has its own radio system and has been assigned a frequency channel to be shared with other companies in the same area, or has been assigned its own frequency channels with little or small potential for inter-company traffic should this be required. In most cases the frequencies are used very inefficiently.

The increasing demand for land mobile communication and the limited availability of frequencies has resulted in an acute deficiency of frequencies in several geographical areas, particularly in and around major urban areas. The only solution to this problem is to use the frequencies more efficiently. One way of doing this is to transmit as much information as possible as digital data, another is to let several users operate on a number of common frequency channels (trunked channels). In a common, trunked system the frequencies can be used 2-7 times more efficiently than in conventional systems. At the same time the overall investment for the base radio station network is reduced or the users can get a more operationally-efficient communications system for the same cost.

In MOBITEK, digital data (e.g. text and status) can be transferred and speech communication can be established on a number of common channels. The fixed network (base radio stations and exchanges) are installed and operated by the network operator. This part should be regarded as a transparent transmission link for data and speech between one terminal's output and another terminal's input. The user can design his own communications system by adapting the design of his terminals to his requirements. The terminals use MOBITEK as a communication link between them.

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2 BASIC REQUIREMENTS

The following requirements have formed the basis for the development work:

- the system must be primarily designed for dispatch traffic.
- the changing over from an existing radio network to MOBITEK is to be facilitated as far as possible,
- it must be possible to use the system for both speech and text and for other data communication between connected units,
- the system must be transparent for user data, customer adaptation of terminals must be possible,
- emergency messages from mobile units must be transmitted in plain text,
- it must be possible to initiate emergency messages from a pocket transmitter when outside a vehicle,
- number dialling must be facilitated and it must be possible to call both individuals and groups,
- the system must keep track of the mobile units so that calls can be automatically routed to the correct base radio station,
- communication must be possible between mobile units and external networks (e.g. telephone and data networks).

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3 TRAFFIC FACILITIES

MOBITEX provides the facilities for message traffic of the store-and-forward type and for traffic via line connections (primarily speech) between terminals connected to the MOBITEX network and between its terminals and external networks (telephone and data networks).

3.1 SUBSCRIPTION

A subscription to MOBITEX comprises either a terminal subscription, linked to a particular mobile or fixed terminal, or a personal subscription which can be moved between different terminals (mobile and fixed). A number of various services can be linked to each subscription.

3.1.1 Terminal subscription

A terminal subscription is linked to a certain terminal connected to the network. There are two types:

- fixed terminal subscription
- mobile terminal subscription

3.1.2 Personal subscription

A personal subscription is not bound to a particular terminal but can be moved between different terminals, both fixed and mobile.

The services subscribed to by a personal subscription may be limited by the terminal it logs-in to.

When logging-in a personal subscription, the user notifies this to the network with a login message, including a password. The log-in becomes valid when the terminal has received an acknowledgement from the network.

The network considers the subscription logged-in to the stated terminal until the subscription either sends a logout message or logs-in to another terminal.

A physical terminal can have up to 7 personal subscriptions logged-in to it at the same time.

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3.2 SUBSCRIPTION SERVICES

3.2.1 Message traffic

One of the main services in MOBITEK is sending and receiving text and data messages. A message can be a status message, a text message, a data message or a HP-data message with freely coded data.

Messages can be both sent and received by:

- * fixed terminal subscriptions
- * mobile terminal subscriptions
- * personal subscriptions

Group numbers for messages can only receive traffic, not initiate.

If a message does not reach an addressee, e.g. if the addressee's terminal is switched off, the sender is given notification of this. Such messages can be stored in a network mailbox and sent to the addressee when available again.

If more text or data is to be transmitted than can be contained in one message, the transmission must be divided into several sub-messages. The network does not control the order in which the different sub-messages are delivered to the receiver. Such a control must be made by the terminals if needed by the application.

3.2.1.1 Status traffic

Frequently recurring messages such as "available", "engaged", "off to lunch" can be coded to a number which is all that is then transmitted. Thus the transmission time can be reduced considerably. There are facilities for 256 different status messages. Coding of the messages is carried out by the user. Terminals, both fixed and mobile, can be designed to translate the status codes to plain text.

3.2.1.2 Data traffic

Freely coded user data is transmitted in the form of data messages of varying lengths. User data must be formatted to complete octets. A data message may contain up to 512 octets of user data. Coding and decoding of information is determined by the user application.

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3.2.1.3 HP-Data traffic

Data packets to be used when more than 512 octets should be sent and when higher protocols above the Mobitex network layer should be used. Each HP-data packet consists of up to 512 octets of user data.

Two different types of higher protocols can be defined, public protocols and user defined protocols, where public protocols have been registered and assigned a protocol identification number by the network operator. User defined protocols, on the other hand, may be used by a terminal without restrictions.

User data must be formatted to complete octets. Coding and decoding of information, concerning the higher protocol used, is determined by the user and his terminals.

3.2.1.4 Text traffic

Data messages in the form of text, coded according to national standards, are called text messages. This coding permits receiving emergency messages and inter-company traffic.

The maximum text length is 512 characters.

3.2.2 Speech (line-connected traffic)

Speech traffic, which is also referred to as line connected traffic, differs from other types of traffic as a real time link is established between the A and B parties. This connection can then be used for transferring speech or other analogue signals.

Line-connected traffic can be exchanged between:

- * fixed terminal subscriptions
- * mobile terminal subscriptions
- * personal subscriptions

Group numbers for line connection can only receive traffic, not initiate.

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3.2.3 Emergency traffic

Emergency traffic is a common name for

- emergency signal/emergency message,
- emergency acknowledgement,
- emergency connection.

3.2.3.1 Emergency signal/Emergency message

Emergency signals are a type of text message which are sent automatically by the mobile terminal after initiation from an emergency button in or outside the vehicle or from a pocket transmitter when away from the vehicle. The emergency signal may contain up to 256 characters. A complete emergency message comprises two parts, one fixed part of 256 characters which is stored in the network as subscriber information and one dynamic part which is accessed in the mobile terminal when the emergency signal is initiated. When the emergency signal, together with the dynamic part, has entered the network, the fixed part, stored in the network, is accessed and appended to the dynamic part. The complete emergency message is then sent to the emergency receiver terminal which is stated in the subscriber information of the subscription sending the emergency.

Emergency signals can be given special priority on the radio path, which gives them quicker access than standard messages, when necessary.

The fixed part of the messages stored in the network, coded according to national standards for text code, shall apply to the dynamic part in the mobile terminal.

The emergency message is presented in plain text at the receiving terminal. The emergency message receiver need not therefore have current conversion lists.

Normally, mobile terminals and personal subscriptions logged-in to mobile terminals generate emergency messages. Likewise, fixed terminals and personal subscriptions act as emergency message receivers. In case other requirements are made, any subscription can both generate and receive emergency messages.

When ordering the subscription it is also possible to define an alternative emergency message receiver. The emergency messages will be sent to the alternative receiver when the ordinary receiver manually has ordered emergency messages to be re-directed.

It is also possible to define a rescue centre as, ordinary or alternative, emergency message receiver. This means

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that there will always be someone who takes care of the emergency message.

3.2.3.2 Emergency acknowledgement

An emergency acknowledgement is a message which is manually initiated from the emergency receiver.

This is used to give the emergency signal transmitter an acknowledgement of that the message is taken care of.

3.2.3.3 Emergency connection

A fixed terminal subscription receiving an emergency message can also initiate an emergency connection. It is addressed to the subscription which sent the emergency signal. It can be used to establish a speech connection between the part initiating the emergency and the emergency receiver. The network establishes a bi-directional line connection. The design of the mobile terminal then determines if the connection is used in either or both directions.

An emergency connection always has a higher priority than a normal line connection. This means that a line connection in progress will be disconnected to the benefit of an emergency connection at a blocking situation.

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3.2.4 Group traffic

A number of terminal subscriptions can be combined and allocated a common group number in addition to the individual terminal numbers.

The group message will only be sent to terminals in a limited geographical area defined by the stated base radio stations together with the fixed terminals for the group.

Personal subscriptions cannot be included in a group. They can, however, generate traffic to groups.

Subscriptions included in a group receive traffic directed to the terminal number, as well as to the group number to which they belong.

A terminal subscription can belong to up to 15 groups, including the All terminals group.

The group numbers are stored in the terminals, and can be updated from the network.

Group traffic is divided into two types, one for messages and one for line connection.

3.2.4.1 Group traffic for messages

Status, text, data and HP-data messages can be sent to this type of group number.

The message is sent to the fixed terminals and the base radio stations stated for the group number.

This type of message is not acknowledged by the receivers. Thus the sender is not quite sure who has received the message. To increase safety, the message is repeated for a number of times.

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3.2.4.2 Group traffic for line connection

Line connection can be requested for this type of group number (e.g. for speech traffic).

Connection concerns the base radio stations and the fixed terminals stated for the group number. There must be at least one base radio station, included in a group.

At the stated base radio stations, the call is transmitted to the group together with a channel change order to a traffic channel. The traffic channel is connected in relay traffic and the mobile terminals can communicate in semi-duplex.

There is no check of which mobile units that have received the call.

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3.3 SUBSCRIPTION FUNCTIONS

Each subscription is characterized by the set of functions (services) which are included, either automatically connected to the type of subscription or optional.

The following table shows possible (P) functions to be launched by each network operator, for fixed, mobile and personal subscriptions.

MOBITEX-function	Type of subscrip.		
	FST	MOB	PERS
Text/HP-data/data traffic	P	P	P
Status traffic		P	P
Speech traffic (line conn.)	P	P	P
Password			P
Emergency traffic	P	P	P
Group traffic status/text/data	P	P	
Group traffic speech (line conn)	P	P	
Partially active		P	
Data interruption on line conn.		P	
Mailbox	P	P	P
External networks (telephone, telex, data networks etc. individually optional)		P	P

Designations: FST fixed terminal subscription
MOB mobile terminal subscription
PERS personal subscription

3.3.1 Text/data-traffic

The subscription can send and receive text, HP-data and data traffic. Barring of incoming or outgoing text/data traffic is possible.

3.3.2 Status traffic

The subscription can send and receive status messages. Barring of incoming or outgoing status traffic is possible.

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3.3.3 Speech traffic/line connection

The subscription can generate and receive a line connection for speech traffic. Barring of incoming or outgoing speech traffic is possible. A mobile terminal requesting a line connection may be put in a queue, where it waits for a radio channel to become available.

3.3.4 Password

Passwords provide protection against unauthorized use of a personal subscription. The network checks when logging in that the correct password according to the subscription information is given. The function is mandatory for a personal subscription.

There is no password for fixed and mobile terminal subscriptions.

3.3.5 Emergency traffic

The emergency service allows the subscriptions listed below to both generate and receive emergency messages. They can also be designated as alternative emergency receivers.

- Fixed terminal subscription
- Mobile terminal subscription
- Personal subscription logged-in at a fixed terminal
- Personal subscription logged-in at a mobile terminal

3.3.6 Group traffic for messages

Only MOB and FST can be included as members in the group and thus accept a group message. All subscription types can generate a message to be sent to group.

3.3.7 Group traffic speech (line connection)

Only MOB and FST can be included as members in the group and thus accept a group connection. All subscription types can generate a group connection.

3.3.8 Closed user groups

A closed user group (CUG) is a group of subscribers who other subscribers can not communicate with. This means that traffic between two subscribers not included in the same CUG is barred by the network.

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All types of subscriptions can be included in a CUG and the number of members in a CUG is unlimited, i.e. it is possible for all network subscribers to be members of the same CUG.

3.3.9 Partially active in MOBITEK

This function means that the mobile terminal can be partially active in MOBITEK, i.e. it monitors the MOBITEK network periodically so that it can be used in between times in another network or can rest to save batteries.

The function means that MOBITEK traffic to the terminal is synchronized with the sweep signals from the base radio station, appearing at predetermined times.

The partially-active service is only available for 1200-bps terminals.

3.3.10 Data interruption in a line connection

This function means that if the subscription is engaged in a line connection, it will be interrupted momentarily for transmission of any text/data/status messages which are addressed to the subscription. Only mobile terminals can have this function (data and speech can be sent simultaneously to fixed terminals at any time).

3.3.11 Mailbox

The mailbox service means that messages, to a subscriber who cannot be reached for some reason (e.g. the terminal is switched off or the personal subscription is logged out) are stored in a network mailbox.

When sending a message, the sender can state whether it is allowed to be stored in mailbox or not.

As soon as contact with the subscription is established again, the messages in the mailbox are sent automatically to the subscription.

3.3.12 Joint-traffic

The signalling between the base radio station and the mobile terminals includes a network identification. This allows different MOBITEK networks to exist in the same area and in the same frequency band. It also prevents mobile terminals from unnecessarily changing between networks (no automatic change of network is allowed).

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When changing network, which is done manually in the mobile, the frame synchronization is replaced. As a result, mobile terminals can only receive roaming signals and other traffic from the network currently selected.

This means that base stations belonging to different networks transmit different frame synchronization patterns.

3.3.13 Traffic areas

The signalling between the base radio station and the mobile terminals includes a also includes an area identification used to specify geographical areas. Such an area is denoted as a traffic area and is given a unique area ID by the network.

A list of area IDs specify the area a mobile terminal may traffic. Outside the specified area, two possible cases exist:

- 1) the terminal is not operational
- 2) the terminal is operational but may be debited a different fee.

When a subscription is registered, the traffic areas the terminal may operate are defined. These area IDs are registered in the network subscription record for each mobile terminal. The area IDs are transferred to the mobile terminal in an MPAK.

A base station is recognized as a member of a traffic area by stating the area ID in the frame head. The area ID is specified by 6 bits. Hence, 64 traffic areas can be defined within a specific network.

During the roaming procedure, the terminal will primarily evaluate the roaming signals from bases belonging to the listed traffic areas. However, other bases may be considered in the roaming procedure if the terminal is allowed to traffic the areas outside the specified areas (see case 2 above). If the terminal lacks a list of area IDs, the roaming procedure will evaluate all roaming signals.

The network checks all packets with respect to traffic areas. If a terminal should try to traffic an area it has not subscribed to, the packets are returned (case 1) or forwarded, but with the possibility for the network operator to use a different fee (case 2).

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3.3.14 External networks

MOBITEX is primarily designed and intended for dispatch traffic between mobile terminals and their dispatch offices and between mobile terminals. The facility for traffic between mobile terminals and other telecommunication networks is included as an optional additional services.

Barring of incoming and/or outgoing access to external networks, on individual subscriber basis is possible. For example, fixed subscriptions as well as personal subscriptions logged-in to a fixed terminal, can be blocked for access to external networks.

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3.4 TRAFFIC LIMITATIONS

3.4.1 Text/data traffic

The maximum quantity of user data in a message is 512 octets. If more data is to be sent, it must be divided into several sub-messages. In this case it is recommended to use the HP data packet type. The network does not control the order in which the different sub-messages are delivered to the receiving terminal.

3.4.2 Line connection

A line connection in progress can be cleared down at any time, by either party and is subject to a time limit, to ensure that call lengths are not excessive. Normally an intermittent "hurry up" tone will be inserted in current line connections before this happens.

A maximum period of time for line connections can be defined. At blocking situations, line connections which have been in progress for more than a specified time may be disconnected one by one for the benefit of new calls.

The line connection can be charged for depending on the way it was disconnected. Either normally within the time limit, after this time limit when the "hurry up" tone is inserted or after the time limit for the "hurry up" tone. This is defined by the network operator.

The traffic limitations described above are both for line connections between MOBITEX subscribers, and for line connections between a MOBITEX subscriber and a subscriber in an external network.

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4 CHARGING PRINCIPLES

MOBITEX offers a very flexible system for charging of subscribers.

Mobitex subscription fees can be divided into the following categories:

- Non recurring fees
- Subscription fees
- Traffic fees

This classification of different fees is motivated by the demand for flexibility in charging.

The charging principles can be made according to the operator wishes.

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5 NUMBERING

For addressing subscriptions and groups the network always uses an address which comprises 24 bits, MOBITEK subscription number (MAN). This provides 16,777,216 combinations which must be represented by 8 decimal digits. In purely operative terms the terminals can, however, be designed to accept abbreviated numbers from the operator. The terminals must then convert the abbreviated number to a complete MAN before the network is called.

A closed user group (CUG) is given an identity which comprises 16 bits. This provides 65,536 combinations.

Bildzeit

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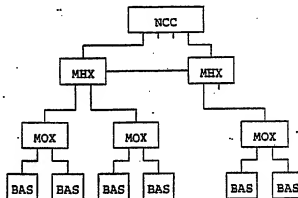
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6 NETWORK STRUCTURE

The MOBITEK system comprises a fixed network (base radio stations and exchanges) with connected terminals. The following describes the network structure whereas the terminals are described in a section of their own later on.

6.1 NETWORK HIERARCHY

The MOBITEK network comprises base radio stations (BAS), area exchanges (MOX), main exchanges (MHX) and the network control centre (NCC). These units are called network nodes. The following figure is an example of a possible network configuration:



TERMINALS (MOBILE and FIXED)

The mobile terminals are connected to the network via the radio channels to the base radio stations (BAS). The fixed terminals are connected to the network via fixed connections to the area exchanges (MOX). As the base radio stations and area exchanges comprise the terminal connection points they are designated the "end nodes" in the network.

Traffic handling, i.e. routing of traffic between terminals, is carried out in the network up to and including level MHX. NCC does not take part in the actual traffic handling - it includes an operation and maintenance function and also a subscription information handler function.

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6.2 MAIN COMPONENTS OF THE NETWORK

6.2.1 Base radio stations (BAS)

The base radio stations constitute end nodes for the mobile terminals. They are also switching points for vehicle-to-vehicle traffic within the respective radio coverage areas. They therefore have the necessary information about the mobile subscriptions within their radio coverage areas to be able to handle this traffic. This is necessary for autonomous operation in the event of a line failure to MOX.

Equipment is installed at the base radio stations for a number of radio channels. One of these is used for the system channel whereas the others are used as traffic channels for speech or data. The number of traffic channels is determined primarily on the basis of the anticipated volume of speech traffic.

6.2.2 Area exchanges (MOX)

Area exchanges constitute end nodes for fixed terminals which are linked to them. They are the switching points for traffic between base radio stations and fixed terminals.

The number of area exchanges will depend to a large extent on the number and distribution of the fixed terminals throughout the country.

6.2.3 Main exchanges (MHX)

The main exchanges route traffic between area and main exchanges. The main exchanges could be connected in a number of various ways, e.g. in a tree or a ring formation.

It is possible to install main exchanges on several routing levels for trunking reasons, i.e. to save data and speech connections.

6.2.4 Network control centre (NCC)

The Network Control Centre (NCC) includes an Operation and Maintenance function together with a Subscription information handler function.

This is where the subscription information is entered and then sent to the main exchanges.

Sketch

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The charging information is collected by this unit during periods of low traffic. After totalling, the necessary basis for accounting is created which can then be sent out by another administrative system.

The operation and maintenance functions consist of collecting central alarms and operating statistics, test function initiation, setting of operating parameters and program loading of all network nodes.

6.2.5 Connections

The combination of both data and speech connections in MOBITECH, means that digital transmission systems are preferable to analog connections between nodes.

For data connections between network nodes; two different interfaces can be used, either X.21bis together with ISO/HDLC or X.25.

Where possible, the connection between two nodes can be split up between different routes, e.g. radio link and cable or different cable routes.

Blockart

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7 TRAFFIC ROUTING

7.1 SUBSCRIPTION INFORMATION

Different types of information about the subscriptions are necessary, both static information such as functions included and dynamic information such as which base radio station the mobile terminal is to use.

7.1.1 Static subscription information

Examples of static information:

- type of subscription,
- subscription number,
- services included,
- the address and fixed part of the emergency message,
- group numbers of which the subscription is a member
- technical data such as frequency band and radio channels available in the terminal.

7.1.2 Dynamic subscription information

Dynamic subscription information is such information about the subscription which is often changed. This information deals with roaming, sequence numbers on the radio path, logging-in of personal subscriptions and activation/inactivation status of terminals.

7.1.2.1 Roaming

Information about which base radio station to be used for a certain terminal is kept within the network and is updated by the mobile terminal when moving from one base radio station to another.

7.1.2.2 Sequence numbers

Messages, which are exchanged between a base radio station and a mobile unit, are always given a sequential number by the sender. When roaming to a new base radio station, the old base radio station sends information about the relevant sequence number to the new base radio station together with other subscription information.

Blockers

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7.1.2.3 Logging-in of personal subscription

For a personal subscription to be used it must first notify the log-in to the network. This is carried out from the new terminal by sending a log-in message to the end node. The log-in is registered in the terminal as well as in the end node. The relevant base radio station stores information about which terminal the personal subscription is using. If the terminal roams to a new base station, the old base radio station will send information about which subscriptions are logged-in to the terminal.

If a personal subscription logs-in to terminal without having logged-out from another terminal, the previous log-in will be cancelled.

A personal subscription normally disconnect itself with a log-out message.

7.1.2.4 Activate/Inactivate

To avoid unnecessary attempts to call subscriptions which are not active, the terminals must notify the network when they are switched on. Fixed terminals do this immediately after switch on by sending an "active" message. Mobile terminals may delay the "active" message so that activation can be made on possible user traffic exchanged within this time. If no traffic has been exchanged with the mobile terminal within this delay period after switch on, an "active" message is sent to the base station.

When a terminal is switched off, it automatically sends an "inactive" message to the network.

If a mobile terminal loses contact with the network and no traffic has been exchanged within a certain time limit, it will send an "active" message after contact with the network has been reestablished again.

Group traffic messages will not cause an activation.

A personal subscription is activated/inactivated at the same time as the terminal to which it is logged-in.

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7.2 ERROR HANDLING

In a network such as MOBITEX, where the majority of the terminals are mobile and communicate via radio, a number of phenomena which cannot be considered as pure faults occur.

- * An acknowledgement of a message can be missed by the unit sending the message. This unit then tries again. To avoid a copy of the message being displayed, the sender (BAS or mobile terminal) allocates a sequential number to all messages. Messages with the same sequential number as the previous one are deleted by the receiving unit (MOB and BAS respectively).
- * If a subscriber cannot be reached, the message will be returned to the sender or will be placed in a mailbox with a message to the sender stating this fact.

7.3 RESERVE ROUTES

The principle is that each node should have a reserve route to another node in addition to the ordinary node.

If the establishment of a reserve node is unsuccessful, the cut-off node will convert to autonomous operation as is described below.

7.4 AUTONOMOUS OPERATION

When contact with a hierarchically superior network node is lost, messages cannot be forwarded upwards in the network. Traffic between terminals under the same autonomous node will be dispatched as usual.

If a mobile terminal which was not under the node when the line break occurred roams in, there will be no facility to receiving traffic information from higher levels in the network. Technical information can then be requested from the mobile terminal.

An attempt to log-in a personal subscription is accepted only if the autonomous node happens to have subscription information for the subscription concerned.

A base radio station may in autonomous operation send incoming emergency messages as general messages to all mobile terminals.

Drawers

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7.5 TRAFFIC CONTROL AND OPTIMIZATION

The algorithms controlling the access to the radio path between a base radio station and a fleet of mobile units are designed to handle all traffic situations. In order to do so, the traffic in the coverage area of the base station is monitored to account for short term variations in the flow of traffic.

It is easily understood that if the major traffic consists of short "Status" messages, the occupation of the radio channel is different from a case with long data packets. Things like this must be taken in account when selecting a traffic algorithm and setting parameters.

On a short term basis the access to the System Channel, and optional data traffic channels is controlled at the base station in order to obtain a high throughput and lowest possible transmission delays of the packets.

On a long term basis, statistical information derived from the traffic situation in a certain area may influence such different issues as installing more radio channels at a base radio station, raising of data rates on connections between nodes, opening of new sites for base radio stations or exchanges etc.

Authors

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8 TERMINALS

A terminal is the equipment used for communication with the MOBITEK network. It contains information about subscriptions logged-in to it.

The terminals can be designed according to the users' requirements within wide limits. However, terminals which are to communicate with each other must be adapted to each other e.g. with respect to the coding of data.

8.1 FIXED TERMINALS

8.1.1 General

Fixed terminals are located at offices or dispatch centres and are connected to the MOBITEK network via fixed links. Connection is made to the closest area exchange.

The connection permits text/data-traffic and line connection at the same time.

The equipment and the application software at the office is normally adapted to the user's special requirements.

8.1.2 Packet oriented terminals

To implement a communication between these terminals and the MOBITEK network, special MOBITEK packets are used. For the link layer interface a number of different interfaces could be used.

Messages are edited and formatted locally in the terminal before they are sent to the MOX as MOBITEK messages.

This group of terminals contains almost unlimited possibilities for customer adaptation. The equipment can be designed to be used only for MOBITEK communication. But it can also be integrated with other computer systems at the company. The operator can then use the same equipment for MOBITEK communication as for other purposes (e.g. data support for error reports, work planning, transport planning etc.).

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Revised:

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8.1.3 Character oriented terminals

Asynchronous terminals work with only one character at a time. To handle this type of terminal, there are special packet assembly/disassembly units (MPAD) in the network. MPAD contains software which handles the characters from the terminal, processes these and creates messages which can be handled by the MOBITEK network. In this way, inexpensive terminals can be used at offices.

8.2 MOBILE TERMINALS

8.2.1 General

The mobile terminals in MOBITEK are considered as communication interfaces which handle signalling and procedures on the radio path and accept and supply information from and to the user and any additional equipment.

The mobile terminal can be divided into the following functional units:

- radio unit
- control unit
- operator's unit
- peripheral equipment

The functional units can be integrated in different ways in different physical units.

8.2.2 Radio unit

The radio unit contains transmitter and receiver. The traffic method is 2-frequency simplex. Full duplex operation is possible during line connections (speech) except for line connections to groups. However, full duplex operation can be restricted or made impossible by frequency assignments.

The radio unit is controlled entirely by the control unit. The control functions include selection of transmitter and receiver frequencies independent of each other, transmitter on/off, noise limiter on/off, signal strength level, modulation to transmitter and LP from receiver etc.

Blanket

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Radio units with different HF bandwidths and different frequency setting facilities are permitted in the system. Limitations on these points will however reduce the mobile terminal's traffic facilities in the network, e.g. in the form of higher blocking probability than for a fully fitted mobile terminal. The user himself must attempt to assess these limitations, bearing in mind current and future communication requirements.

8.2.3 Control unit

The mobile control unit (MCU) contains the hardware and software required for radio signalling and to control the different inputs and outputs. These are designed for connecting peripheral equipment such as operator's unit, microphone, loudspeaker, printer, display, key board etc.

8.2.4 Operator unit

An operator unit is necessary for the primary manoeuvring of the mobile terminal. This can be designed in different ways depending on how the mobile terminal is used as a whole. The design can vary from the simplest with on/off switch, volume control, call button and a limited number of status buttons to a complete ASCII keyboard with function keys, perhaps integrated for use with other systems in the vehicle. The operator's unit can also be integrated with a hand set.

Bidkort

Diagram

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8.2.5 Peripheral equipment

Additional peripheral equipment can be connected to the mobile control unit. Its facilities are determined by the user in his application and his specification of the mobile control unit.

Future changes and developments will be facilitated if MCU is specified with standardized in and outputs.

A few examples of possible additional equipment are:

- paper printer,
- video terminal,
- LCD display,
- emergency receiver for receiving emergency messages from portable emergency transmitters,
- cash terminal,
- holders for code plugs, which can contain personal code numbers, personal emergency messages, login sequences etc.,
- equipment for automatic vehicle location,
- taxi meters,
- computerized systems, e.g. automatic measurement and data systems,
- bar code reader,
- credit card reader.

8.2.6 Serial number control

The electronic serial number (ESN) is stored together with the terminal subscription MAN. The use of this number is meant to protect the mobile terminal from unauthorized use.

The network layer include possibilities for the system to request and receive information about the ESN from a specific terminal.

The ESN of the terminal is checked by the terminal itself at power on.

Bidsort

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9 RADIO PATH

9.1 RADIO FREQUENCIES

9.1.1 Frequency bands and channel numbering

The MOBITEK network is not bound to the use of certain frequency bands or sub-bands or channels with a fixed duplex spacing. This means that a vacant frequency in a frequency band can be assigned to MOBITEK without any major problems in the network. This assumes however that an overall numbering of the frequency channels in the band is established and that the mobile units can traffic any frequency pair in the entire frequency band (wideband stations with full synthesis and 2-frequency simplex without linking between the receiver frequency and the transmitter frequency).

The MOBITEK radio protocol have been proven to work in frequency bands from 80 MHz to 900 MHz.

9.1.2 Channel usage

The base radio stations work in duplex while the mobile terminals work in two-frequency simplex (semi-duplex). However, full duplex operation is possible during line connections (speech) except for line connections to groups.

One or more of the channels are used as system channel(s). The system channels are used both for system messages, e.g. for ordering the mobile terminal to a traffic channel, and for handling data traffic.

In addition to the system channel(s) there are a number of traffic channels at each base radio station which can be used for data or speech traffic.

At most base radio stations, system signalling and data traffic are handled on a system channel and traffic channels are used primarily for speech. At base radio stations with considerable traffic, the mobile terminals can be ordered to traffic channels for data traffic.

Buildings

Signet

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9.2 TRAFFIC CAPACITY

The network throughput for data can be expressed both as a maximum number of packet transmitted over a radio path and as the maximum number of packets a network node can handle per time unit. It is also of interest to express the average forwarding time for a message.

The capacity of the network depends on the software and hardware release version.

The traffic capacity for speech can be estimated by using traditional Erlang calculation based on assumptions of expected average intensities and durations of the calls.

Bulkies

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9.3 RADIO PROTOCOL

9.3.1 GENERAL

The radio protocol described in this chapter consists of a data link layer and a physical layer. It ensures a reliable and efficient transmission path between the mobile terminal and the base radio stations.

9.3.2 RADIO DATA TRANSMISSION SPEED

Both 1200 bps and 8000 bps radio data transmission speed can be used to connect the mobile terminals to the MOBITEK network.

9.3.3 FRAME STRUCTURE

A message is sent in a frame with the following general structure:

Frame header	Primary block	Following block #n
--------------	---------------	------	--------------------

The frame header is included in the frame by the physical layer to establish synchronization. It includes the network identification (i.e the frame synchronization) the base identification number, the area identification and a set of control flags.

To achieve high transmission reliability, the frames are divided into blocks where each block is coded. The primary block contains control information and the address of the mobile terminal.

The network layer information is put in the following blocks, the number of following blocks depends on the amount of information to be transferred.

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9.3.4 BASIC RULES

A mobile terminal with no traffic to send, monitors the system channel. Traffic to the mobile is sent on the system channel, either in the form of a complete message or as a channel change order. After a channel change order, the message is transmitted or a speech connection is established on the new channel.

A mobile terminal with traffic to send awaits a <FREE> signal indicating which terminals have access to the channel. Speech connections must be preceded by a request for channel access.

9.3.5 ADDRESSING AND CHOICE OF BASE RADIO STATION

When a mobile terminal transmits a message it always uses its own subscription number in the primary block. When a mobile receives messages it listens for its own subscription number or a group number to which it belongs.

The base radio station is only addressed in the frame header, using the base identification number. The mobile unit determines itself which base radio station is to be addressed when a call is sent. The choice of base radio station is carried out with the guidance of the reception of roaming signals. The quality of all base stations received is monitored by the mobile unit by counting a weighted number of roaming signals received from each base station.

9.3.6 REPETITION

A message that is not acknowledged by the base station before the next <FREE> signal, is repeated by the mobile terminal. This repetition follows the same rules as the first attempt. The maximum number of repetitions allowed before the transmission is considered as failed is stated in the <SWEEP> signals from the base and defined by network operator.

If the base station gets no response from the mobile terminal within a certain time limit the entire message is repeated. The maximum number of repetitions allowed before the transmission is considered as failed is defined by the network operator.

If the mobile or the base station detects, by a checksum calculation, that one or more of the received blocks are incorrect and cannot be corrected, it requests a repetition of these blocks. These (selective) repetitions are requested until a correct message has been received and acknowledged. Short messages, comprising only a few blocks, are repeated in whole.

Blockers

Repeat

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9.3.7 MESSAGE SEQUENCE NUMBERS

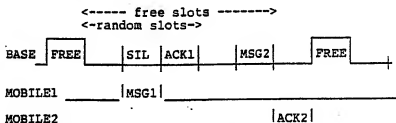
Each message to and from a mobile terminal is given a sequential number (0-15) by the sender. A message received with the same sequential number as the one immediately before, is deleted. In this way, a repeated message due to the sending unit not detecting the acknowledgement, will not be presented more than once to the user.

9.3.8 CHANNEL ACCESS ALGORITHMS

To reduce the probability of collisions between mobile transmissions, an access method with time slots is used. This method is based on the slotted ALOHA algorithm.

Spontaneous transmission from a mobile unit must only be made during a free cycle. The base station indicates the start of a free cycle by transmitting a <FREE> signal. The free cycle is divided into slots of equal length. The total number of slots (FREE-SLOTS) and the length of a single slot is stated in the <FREE> signal.

Mobile traffic initiated by the user before the start of the free cycle (MOBILE 1) is distributed at random. A random number generator selects one of the random slots defined in the <FREE> signal (RND-SLOTS). Transmission begins at the start of the selected random slot, if it is still allowed.



Traffic initiated during the free cycle is sent at the beginning of the next free slot.

If two or more messages collide, the base station may be unable to read them and no acknowledgement will be transmitted. When a new <FREE> signal is sent the mobile units which sent the colliding frames will renew their attempts, this time (individually) choosing a random slot. Before a new <FREE> signal is transmitted, the base station may send an outgoing message (MSG 2 to MOBILE 2).

To prevent a message from being disturbed by transmissions from other mobile units, the base station can transmit a silence signal (SIL) when detecting the start of a

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message. With the silence signal, the base station withdraws the permission to transmit in the following slots.

9.3.9 MOBILE FLEET DIVISION

The access permission in the free cycle can be given to parts (subsets) of the mobile fleet according to the <FREE> signal to reduce the number of access attempts.

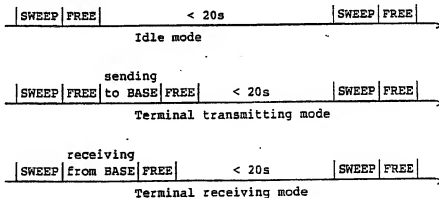
The address and mask fields in a <FREE> signal (or a <SWEEP> signal) are used for a binary division (1, 2, 4, 8 etc) of the mobile fleet.

In a <FREE> signal, the traffic type parameter gives access only for messages of the traffic types: emergency, data and/or speech. This may be changed from the Network Control Centre (NCC).

9.3.10 SYSTEM SIGNALLING

A system channel is used both for system messages and user traffic. Periodic sweep signalling is used on all system channels to set up system parameters, such as the interval between <SWEEP> signals.

The following figures show some examples of system channel signalling:



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9.4 TRAFFIC HANDLING ON RADIO CHANNELS

At base radio stations with only a small amount of traffic or during periods of low traffic, the system channel is the only channel open for data traffic.

When the traffic load increases on a base radio station it is possible to open a local system channel by an order from the NCC. The <SWEEP> signals on the system channel then orders parts of the fleet of mobile terminals to the local system channel to reduce traffic on the system channel. A base radio station can operate several local system channels.

If the call intensity from the mobile terminals is too great for a system channel, the base radio station can open one or more access channels. Calls from mobiles are then spread across several channels and the risk of collision is decreased. The <SWEEP> signals on the system channel includes information about open access channels.

A set of channels for each base radio station may be dedicated for speech connection traffic only.

Endkurt

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A new algorithm for roaming and channel software access as been defined by ERITEL for implementation in Mobitex System release R12. This algorithm is considerably different from (and not backward-compatible) the 1200 bps R4B specifications. In quick overview:

- * The mobile measures the received signal strength (in dBu V emf) of signals from the base stations instead of counting in ROAM signals.
- * The mobiles use all received frame heads from the base station in its measurement and evaluation, not just ROAM signals.
- * A new scanning mode is implemented, for which base stations' system channel must be continuously on. In this mode of operation, the mobile should scan about 10 channels per second.

When the mobile has contact with a base station, it monitors the current system channel, and also scans other system channels given by the network (in the <SVP> frame). the procedure can be diagrammed thus:

<SVP>

```

#####|#####|#####|

```

where "mmmmmm" means monitor the current system channel
 "sss..." means scan other system channels(s), and "e" means
 evaluate the received signals.

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Mr. Ms.		
Station Name	Rev.	PC File

The length of the period during which the mobile monitors other system channels is given in the <SVP> frame as SCAN-TIME. The starting time of the "sss." sequence is different for different groups of mobiles, based on their having an odd or even MAN, as follows:

scan start (odd) = TIME TO NEXT - 10ms - 2* SCAN TIME
scan start (even) = TIME TO NEXT - 10ms - SCAN TIME

where TIME TO NEXT is the time to the next <SVP>, as given in the last <SVP> frame.

The mobile has two different ways to evaluate system channels other than the current system channel - FRAME MODE and CONTINUOUS MODE. Which mode the mobiles should use is given in the <SVP> frame as RSSI_PROC.

* In FRAME MODE, the mobile measures the signal strength during all frame heads. This mode is similar to that used for monitoring the current system channel. In this mode the mobile has to stay on the same channel for approximately one second (and perhaps longer) in order to receive at least one frame head. The length of time over which to make measurements is given in the <SVP> frame as RSSI_PERIOD.

* In CONTINUOUS MODE, the mobile measures the signal strength during a short period (typically 100ms) on each channel. Here, the mobiles do not care whether it receives frame heads or any other type of traffic; it is measuring the carrier, which must be continuously on. Note that in this mode, the mobile does not initially know the identity of the base station whose signal it is monitoring, since it is not reading frame heads.

Quick Scanning Procedure:

When a mobile loses contact with the network it enters a "quick scanning" mode. In this mode the mobile monitors each likely channel for a short period. The channels are scanned in the following order:

1. The channels in the current (neighbour) list given in the <SVP>.
2. The channels in the current list stored in PROM.

At the system operator's discretion, the default list may be temporarily replaced by a shorter list (called the "temporary default list") of system channels in the mobile's usual operating area.

Subpart

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The mobile scans "n" channels from the above scheme (where "n" is a number defined by the system operator - typically 10), and then monitors the last used system channel again. It then scans "n" new channels from the lists and returns to the last used system channel, and so on. When all the channels from both the lists have been scanned, cycling repeats over the default list only with periodic returns to the last used system channel. When a measured channel has a satisfactory signal strength (as given by GOOD_BASE in the <SVP>), the mobile continues to evaluate this channel for a few seconds (typically 3) before finally selecting it as the new system channel. In the case of CONTINUOUS MODE operation, the mobile must at this point acquire and examine one or more frame heads in order to determine whether or not it has evaluated a valid system base station.

If the mobile is able to use the CONTINUOUS MODE of scanning as described above, the scanning of each channel takes about 100 ms (including channel switching time). The last used system channel is therefore examined every second and the recovery time from a temporary cutoff (tunnel, elevator, garage, etc.) is reduced dramatically. If the system operator has chosen to use the FRAME MODE method, the time for getting back to the last used system channel is still much shorter for the old (R11) method, but significantly longer than for CONTINUOUS MODE operation.

Criteria for Leaving the Current Base:

The mobile leaves the current system channel and starts the roaming procedure in four cases:

1. The signal level of the current base is too low (below the values of BAD_BASE from the <SVP>).
2. Another base (BEST_BASE) has a signal strength that is higher than that of the current base, and the difference is greater than the value BETTER_BASE given in the <SVP>. This is typically 10-15 dB. Before the move takes place, the signal strength from BEST_BASE, averaged from frame heads measured during the next sweep period, still must fulfill this criterion.
3. The mobile has made MAX_REP retransmissions without receiving an acknowledgement from the base. MAX_REP is also given in the <SVP> frame.
4. The mobile has not received a valid <SVP> frame within two <SVP> periods.

Product

Report

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Summary of information in the <SVP> frame:

The following information relating to the roaming procedure is provided to the mobile within a <SVP> frame (subtype 1):

RSSI_PROC - states the method of the signal strength measurement.

0 = FRAME, 1 = CONTINUOUS. The default is FRAME.

RSSI_PERIOD - The time used by the roaming algorithm, over which to average received signal strength.

(0-255) * 20 ms. The default is 2960 ms.

SCAN_TIME - The length of the period during which the mobile scans other system channels.

(0-255) * 100 ms. The default is 3000 ms (3 seconds).

BAD_BASE - The signal strength from the current base that is just satisfactory for use.

(0-255) dBuV emf. The default is 15 dBuV emf.

GOOD_BASE - A satisfactory signal strength to accept for a new base selection as current base.

(0-255) dBuV emf. The default is 15 dBuV emf.

BETTER_BASE - The signal strength improvement in dB, above which the mobile should switch to a new base from the current base.

(0-255). The default is 10 dB.

TIME_TO_NEXT - The time in seconds to the next <SVP> frame.

(0-255). The default is 10 sec.

MAX_REP - The maximum number of repetitions allowed for unacknowledged messages.

(0-255). The default value is set by the system operator. Cantel's default value is 5.

Other Information:

The RSSI signal from the mobile transceiver should be able to indicate signal strength over the range 0-50 dBuV emf. 0dBuV emf corresponds to 113dBm (assuming 50 ohm impedance). The time constant of the RSSI signal from the transceiver should be 1 ms, and the mobile should sample the RSSI signal with a frequency of 1000 samples per second and obtain the samples from which to derive average RSSI.

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References:

Chapter 6 discusses scanning procedures in more detail.

Chapter 16 pages 17-23, discusses the roaming procedure in more detail.

Chapter 18 page 17, gives information on the signal strength indication to be provided by the mobile receiver. See also page 14 of chapter 17.

The <SVP> frame is detailed in Appendix A of Chapter 16, pages 28-34.

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Doc. No. 1(6)

REQUIREMENT SPECIFICATIONS

Design: Project ET/SYS M0t	Fabrication: Project/Program ET/SYS M0t	No. 1056 - A 296 5170 Ue Date: 1990-02-16 Rev. B File: MTS03.1
Design: Design: Correspondence ET/SYSC STT <i>STT</i>		Title: MOBITEX Terminal specification General description of terminals
<div style="text-align: center; margin-bottom: 20px;"> Cantel Mobitex </div> <p><u>SUMMARY</u></p> <p>To the MOBITEX network fixed and mobile terminals can be connected.</p> <p>Fixed terminals are connected via a line interface whereas mobile units are connected by a radio interface. Layer division has been applied to the definition of the terminal's functions.</p> <p>The upper layers are common to both types of terminals, whereas the lower layers are available in two versions, one for fixed terminals and one for mobile terminals.</p>		

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<table border="1"> <tr> <td>Version Date 1990-02-16</td> <td>Rev B</td> <td>Pl. File MTS03.1</td> </tr> </table>	Version Date 1990-02-16	Rev B	Pl. File MTS03.1
Version Date 1990-02-16	Rev B	Pl. File MTS03.1	

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No. No.	1056 - A 296 5170 Ue	
Doc. No.	1990-02-16	Rev. B
Doc. No.	MTS03.1	

1 INTRODUCTION

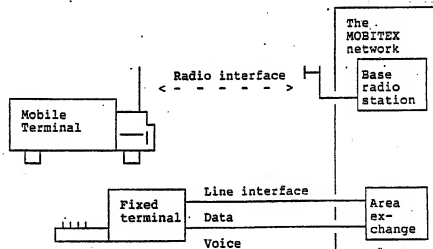
1.1 GENERAL

The term terminal refers to a physical unit which can be connected to the MOBITEX network.

There are two types of terminals:

- Fixed terminals which are connected via separate line interfaces for data and voice.
- Mobile units which are connected via a radio interface.

Communication through the network is done with packets for both terminals. The designation message (MPAK) for this packet also appears in the set of documents.



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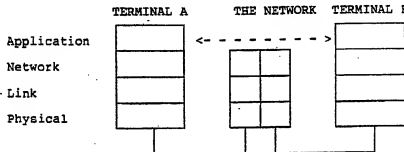
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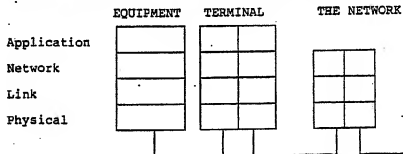
1.2 DIVISION INTO LAYERS IN MOBITEX



The physical layer and the link layer separate the terminals. The network layer is identical for both types of terminals. In the superior layer, the application layer, MOBITEX makes demands on the handling of certain addressing methods. The requirements which are demanded in the application layer are identical for both types of terminals.

In certain applications, the peripheral equipment is connected to the terminals. We recommend certain interfaces for connection to such equipment. See reference RI-19 for further information.

A terminal with peripheral equipment connected can be symbolized according to the following model:



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2 FIXED TERMINALS

A fixed terminal is connected via a line interface and a voice interface to the MOBITEK network. The terminal communicates with exchanges which constitute the network's end nodes for fixed terminals.

3 MOBILE TERMINALS

A mobile terminal is connected via a radio interface to the MOBITEK network. The terminal communicates with base radio stations which constitute the network's end nodes for mobile terminals. It is up to the mobile terminal to select which base radio station to belong to at the particular time by continuously listening for addresses for adjacent base radio stations.

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4 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-19, 4

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEX System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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LIST OF ACRONYMS USED IN SPECIFICATION

Most of the acronyms used in the Mobitex Documentation are of Swedish origin. For convenience of readers all these acronyms have been listed alphabetically and a pertinent explanation provided. The most common are described in this documentation with English acronyms, therefore whenever there is a risk of misunderstanding, use this guide for translation/explanation.

Swedish/English Acronym	Explanation
AAT	Change access request, speech
ABD	Access request, data
ABL	Access request, emergency
ACT	Access request, speech
ACK	Acknowledgement
AKT	Activity request
ANS	American National Standard Institute
ASCI	American Standard Code for Information Interchange
ATD	Access permission, data
ATL	Access permission, emergency
ATT	Access permission, speech
BASE	Radio Base station
BBT	Change base station, speech
BKD	Change channel, data
BKE	Base station control unit
BKT	Change channel, speech
BMON	Base Contact Monitoring
BPSK	Binary phase shift keying
CODE	Coding and Readout
DCOD	Input and decoding
EBC	Computer rack
EBR 8/900	Radio rack
EEPROM	Electrically Erasable PROM
FRI	Free Signal
FST	Fixed terminal subscription
GMSK	Gaussian minimum shift keying
HDLC	High-level data link control
IFRA	Processing Incoming Frame
ISI	Intersymbol interference
ISO	International Standards Organization
KKE	Channel control unit
LKE	Line concentrator unit

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Rev. No.

Swedish/English

Acronym

Explanation

LSB	Least Significant Bit
MAN	Terminal subscription number
MASC	Mobitex asynchronous communication protocol
MCU	Mobile control unit (as part of modem)
MFL	Personal subscription
MI	Modulation Index
MOB	Mobile terminal subscription
MOX	Local exchange
MPAD	Mobitex packet assembly/disassembly
MLE	MOX line concentrator unit
MOA	Mobitex Operator Association
MPAK	Mobitex packet
MRM	M-Frame
MSB	Most Significant Bit
MSE	MOX control unit
MX	Main exchange
NACK	Negative acknowledgement
NAM	Number assignment module
NAT	No access permission, speech
NCC	Network control center
NSC	National system channel
OCTET	Byte (8 bits)
OFRA	Processing Outgoing Frames
OSI	Open System Interconnect
PADS	X.25 packet assembler/disassembler
PAHA	Packet Handling
PERS	Personal Subscription
POT	Plain Old Telephone
PROM	Programmable read-only memory
PS	Personal Subscription
RACK	Request for repetition of the last sent ACK
RAM	Random Access Memory
REB	Repetition Request
RES	Repetition Reply
RMD	RAM Mobile Data
ROSI	Radio Signalling Protocol (RSP)
RSSI	Radio Signal Strength Indication
SACK	SENS Acknowledgement
SENS	Link Layer Control
SVP	Sweep Signal

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Swedish/English

Acronym

Explanation

TEL	Public switched telephone network com. unit
TST	Silence order
UTG	Mobile Unit Output Port Identifier
VCO	Voltage controlled Oscillator
VKT	Wait for channel, speech

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LIST OF ABBREVIATIONS USED IN SPECIFICATIONS

SWEDISH/ENGLISH

EXPLANATION

ACTIVE	Terminal active
ADDCONFAS	Conn. Req. w/additional info fast
ADDCONFREQ	Conn. Req. w/additional info
AREALIST	List valid area IDs
BORN	Terminal active for the first time
CLOOPOFF	Circuit Loop Test End
CLOOPON	Circuit Loop Test Start
CONFAS	Connection Request Fast
CONGRA	Connection Request Granted
CONORD	Connection order for group call
CONREA	Ready for connection
CONREQ	Connection Request
CSUBCOM	Circuit switching for subscriber and emerg/comm.
DIE	Term. not permitted to send use traffic
DISCON	Disconnection of connection
DTERSERV	Data Terminal Service Communication
ESNINFO	Electronic Serial Number Information
ESNREQ	Electronic Serial Number Request
EXTCONFREQ	External Connection Request
FLEXLIST	List of personal subscription MAN's
FLEXREQ	List of Pers. Subscription MAN request
GROUPLIST	List of Group MANs
INACTIVE	Terminal not active
INFO	Terminal Information
INFOREQ	Terminal Information request
LINEOFF	Line Connection Off
LINEON	Line Connection On
LNSEL	Line selected
LIVE	The terminal may send packets again
LOGINGRA	Login Request Granted
LOGINREF	Login Request Refused
LOGINREQ	Login Request
LOGOUT	Logout
LOGOUTORD	Logout order
MPAK	Mobitex Packet
PSOSCOM	Packet switched emergency communication
PSUBCOM	Packet switched subscriber communication
ROAM	Roaming Message
ROAMORD	Roaming Order
SOS	Emergency signal

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SWEDISH/ENGLISH

SOSACK
SOSCONFAST
SOSCONREQ
SOSRX
VICESOSRX

EXPLANATION

Emergency Acknowledgement
Emergency Connection Request Fast
Emergency Connection Request
Cancel Emergency re-direction
Re-direction of emergency messages.

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Document
TERMINOLOGY

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Types Prepared ET/SYS MÖt	Futurework Superresponse ET/SYS MÖt	Sr. No. 0033 - LZBA 703 1001 Ue
Declarer/Editor/Corr. (as response approved) ET/SYSC STT <i>STT</i>		Date - Date Rev En. F.s 1990-02-16 E MTS04.1
Summary Cantel Mobitex-		Title MOBITEX Terminology and abbreviations
<p><u>SUMMARY</u></p> <p>This document includes the terminology and abbreviations used in the terminal specification.</p>		
<p>Subject</p> <p>Reprod</p>		

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1 TERMINOLOGY

The following list gives certain specially defined terms used in the MOBITEK Terminal Specifications.

The terms are listed in alphabetical order.

A-PARTY	The originating unit of the message or the line connection. i.e. the calling part.
AREA EXCHANGE	MOBITEK area exchange. Constitutes the end node for fixed terminals.
B-PARTY	The intended receiving unit of the message or the line connection, i.e. the called part.
BASE RADIO STATION	A base radio station is a network node which constitutes a link between a number of mobile terminals and the MOBITEK network. A base radio station transmits traffic on one or more radio channels.
CIRCUIT SWITCHED CONNECTION OR LINE CONNECTION	A circuit switched connection or line connection is a real time connection between terminals. The traffic over a line connection is normally speech communication.
EXTERNAL NETWORK	In the MOBITEK network there are special gateways to other public networks such as the datex network, the telex network and the data packet network.
FIXED TERMINAL	A fixed terminal is equipment connected to MOBITEK by a leased line connection. The equipment possesses a Fixed Terminal Subscription and can also belong to one or several group numbers. In addition, one or more transferable subscriptions can be logged in to the terminal.
MAIN EXCHANGE	MOBITEK main exchange. Connects the area exchanges.

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MOBILE TERMINAL

A mobile terminal is equipment connected to MOBITEK via a radio path to a base radio station.

The equipment possesses a Mobile Terminal Subscription and can also belong to one or several group numbers. In addition, one or more personal subscriptions can be logged in to the terminal.

MOBITEK TEXT CODE

Coded character set for the data interchange, according to national standard.

NETWORK CONTROL CENTRE

Consists of a subscription handler part and a operation and maintenance part.

USER TRAFFIC

User traffic is the messages transmitted between terminals connected to MOBITEK. There are user messages with different characteristics. These are differentiated according to different traffic types.

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2 ABBREVIATIONS

The following abbreviations are used in MOBITEK terminal specification. Most of the abbreviations are explained in the terminology chapter.

BAS	Base radio station
FST	Fixed terminal
MAN	Subscription number
MEX	Main exchange
MOB	Mobile terminal
MOX	Area exchange
NCC	Network control centre
PERS.	Personal subscription

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REFERENCES

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CURRENT PROGRAM ET/SYS Möt	PROGRAMMING - SOURCE/PROGRAM ET/SYS Möt	No. No 0015 - LZBA 703 1001 Ue
DESIGNER/DESIGNER'S RESPONSIBILITY ET/SYSC STT <i>STT</i>	DESIGN DATE 1990-02-16 E	REV. NO. MTS05.1
REMARKS Cantel Mobitex:		TITLE MOBITEX Terminal specification References
<p style="text-align: center;"><u>INTRODUCTION</u></p> <p>The reader should have a number of documents and publications at hand, referred to in the terminal specification. This document lists the necessary references.</p> <p><u>Note:</u> Internal references, i.e. to other sections in the Terminal specification, are described in section Arrangement of the documents.</p>		
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1 CCITT RECOMMENDATIONS

The following CCITT recommendations are referred to in this set of documents:

- V.10 Electrical characteristics for unbalanced double current interchange circuits for general use with integrated circuit equipment in the field of data communications.
- V.11 Electrical characteristics for balanced double current interchange circuits for general use with integrated circuit equipment in the field of data communications.
- V.24 List of definitions for interchange circuits between data terminal equipment and data circuit terminating equipment.
- V.28 Electrical characteristics for unbalanced double current interchange circuits.
- V.52 Characteristics of distortion and error-rate measuring apparatus for data transmission.
- X.1 International users of service in public data networks.
- X.21 (X.21 bis) Use on public data networks of data terminal equipment (DTE) which is designed for interfacing to synchronous V-series modems.
- X.24 List of definitions for interchange circuits between data terminal equipment (DTE) and data circuit terminating equipment (DCE) on public data networks.
- X.25 Interface between data terminal equipment (DTE) and data circuit-terminating equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit.
- X.26 (Refer to V10)
- X.27 (Refer to V10)

The above recommendations are found in:

CCITT Recommendations Volume VIII (Fascicle VIII.1 - VIII.3) from VIIth Plenary Assembly 1980 (Yellow Book).

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In addition, there are references to the following CCITT recommendations:

P.53 A Psophometers, apparatus for the objective measurement of circuit noise.

CCITT Recommendation Volume V (Telephone transmission quality) from VIIth Plenary Assembly 1980 (Yellow Book)

2 OTHER INTERNATIONAL STANDARDS

ISO 646 Data representation - coded character set for the data interchange. National additions to be used are stated in reference RI-06.

ISO 2110 Data communication - 25 pin DTE/DCE interface connectors and pin assignments.

ISO 3309-1984 (E) Data communication - High-level data link control procedures - Frame structure.

ISO 4335-1984 (E) Datacommunication - High-level data link control procedures - Elements of procedures

ISO 4903-1980 (E) Data communication - 15 pin DTE/DCE interface connectors and pin assignments.

ISO 7809-1984 (E) Information processing systems - Data communication - High level data link control procedures - Consolidation of classes of procedures.

GA27-3004-2 IBM General Information - Binary Synchronous Communication.

CEPT Recommendation T/R 24-1
Recommendation for Radio equipment (Only a draft is available, at the time of publishing of these specifications.)

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3 NATIONAL REGULATIONS FOR RADIO EQUIPMENT

Regulations to be used for national type approval are stated in reference R1-06.

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4 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on.

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Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEX System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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Network Operator Information (Canada)

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1. INTRODUCTION

This chapter includes requirements that are specific to the design of equipment for use on the Cantel Mobitex network in Canada. They also apply to Equipment to be used in the United States on either a "roaming to U.S. basis", or on a subscription in the U.S.

The sections headings in this chapter describe technical requirements, which are either brand new, or have been touched briefly in other chapters of the specification, and cross referenced to this Chapter 6 for a more detailed explanation.

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2. CANTEL NETWORK ASPECTS

This section specifies the network capabilities and parameters that are specific to the Cantel Mobitex network.

2.1 SUBSCRIPTION FUNCTIONS SUPPORTED

The subscription functions supported by Cantel are as indicated in the following table:

<u>Mobitex-Function</u>	<u>Subscription Type</u>
	<u>FST</u> <u>MOB</u> <u>PERS</u>
Text/Data-Traffic	* * *
Status Traffic	* * *
Password	* * *
Alert Message Service	* * *
Group Traffic/Text/Data	* * *
Mailbox	* * *
External Networks	* * *

Designations:

FST = Fixed Terminal Type

MOB = Mobile Unit Type

PERS = Personal Subscription

2.1.1 ALERT MESSAGE SERVICE

Alert Message traffic may be generated or received by any subscription type (fixed terminal, mobile unit, personal login at fixed terminal, and personal login at mobile terminal). Any of these subscription types may also be designated as an alternative Alert Message Receiver.

2.1.2 MOBITEK TEXT CODE

The text code used for TEXT TRAFFIC and EMERGENCY MESSAGES in the Mobitex Network is ANSI X3.4-1977 (which is derived from ISO 646 with national extensions). Each character is represented by one octet consisting of the 7-bit ANSI X3.4 code with the eighth bit set to zero.

2.2 MAN NUMBERING PLAN

The Mobitex network subscription address is based on a 24-bit number known as the MAN number.

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The MAN numbering plan for Cantel is partitioned as follows:

<u>MAN Number</u>	<u>Usage</u>
0	Not used
1	MOBITEX Network
2 - 6	External Networks
7	All Terminals MAN
8 - 20	External networks
21 - 99,999	Reserved for future use
100,000 - 16,777,215	Subscriptions and groups

Specific assignment of External networks will be determined later.

The MAN range allocated to subscription (>100,000) will be further partitioned to facilitate network administration and joint traffic with other Mobitex networks.

Cantel will use MAN numbers in the range 2,000,000 - 2,999,999.

2.2.1 JOINT TRAFFIC

Unique frame synchronization patterns are assigned to each Mobitex network (see Sect. 4.1), so as to preclude automatic switching between networks. However, mobile terminals intended for use in both the US and Canada must be designed to allow manual switching between the RMD and CANTEL networks. This network switching capability requires that the mobile unit permanently store all required synchronization patterns. Multiple channel default lists must also be accommodated in such mobile terminals.

Actual Internetworking between RMD and CANTEL is planned to be implemented at some future date.

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2.3 HP-DATA PROTOCOLS APPROVED BY MOA

The network allows up to 255 different higher level protocols for use with HP-Data. Protocols 1-127 will be defined by MOA and supported as needed by Cantel. At the present time, no HP-Data codes have been assigned. Protocols 128-255 are free to be defined on a per application basis.

2.4 NETWORK MESSAGES

Messages received by the mobile terminals include a "traffic state". For all non-zero states, it is required that both the decimal value (0-7) and the "traffic state" and its meaning be presented to the user in plain English text as indicated in R1-09 (Sect. 3.2.3) and R1-08 (Sect. 2.5)

2.5 CHARGING PRINCIPLES

The Canada tariff for users of the Mobitex network is stated elsewhere and is not part of this specification.

2.6 ACCEPTANCE TESTING

Equipment to be used on the Cantel Mobitex network will be tested by Cantel in this specification, and certified as satisfactory for use on the network.

3. FIXED TERMINAL INFORMATION

3.1 BIT RATES AND PROTOCOLS FOR FIXED TERMINALS

The bit rates for different fixed terminals interfaces supported by the network for different standard protocols is as follows:

Terminal Interface: Supported Bit Rates (Kbps):

HDLC	2.4, 4.8, 9.6,
X.25	2.4, 4.8, 9.6,
MASC	1.2, 2.4

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3.2 ELECTRICAL REQUIREMENTS

Fixed terminals shall be designed to operate with standard line voltages found in Canada.

Fixed terminal equipment that operates from AC power must meet all relevant CSA regulations, be tested by the CSA and bear a specified CSA label.

3.3 SPECIFICATION OF LINE CONNECTION

Access lines between fixed terminals and the Mobitex network will generally be provided by a third party telecommunications vendor. Fixed terminals and associated data communications equipment will necessarily meet the specifications of these telecommunications vendors.

4 MOBILE TERMINAL INFORMATION

4.1 NETWORK IDENTIFICATION NUMBER

Network identification makes it possible to have different Mobitex networks operating in the same area, on the same frequency band, without arbitrary and uncontrolled roaming of mobiles and portable units between base stations on the different networks. (For example, RAM Mobile Data in the U.S. and CANTEL in Canada will have Mobitex networks in the same 900 MHz SMR band, and uncontrollable roaming between these two networks is undesirable.) The particular network within which unit is to operate is specified by means of the frame synchronization pattern of the frame head in the physical layer of the radio protocol (bits 17-32). These patterns are assigned and administered by the Mobitex Operators' Association (MOA). The patterns are specified below.

ID NUMBER	ORIGINATOR	BIT NUMBER 01.....16	NETWORK
1	Mobile/Port. Base	1100010011010111 1100010011010111	CANTEL, Canada
2	Mobile/Port Base	1011010000110011 1011010000110011	RMD, U.S.

The identification number to be used by the mobile unit may be selected by a switch on the unit or by other means.

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4.2 AREA IDENTIFICATION NUMBER

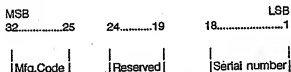
The area identification number is also a part of the frame head in the physical layer (bits 39-44), and is used to designate a particular group of base radio stations in a particular operating area of the Cantel Mobitex network. A maximum of 14 operating areas will be defined in Cantel Mobitex network. The mobile must be capable of storing an "operation allowed" list of these numbers in non-volatile memory. The binary area identification "0" designates ability to operate in all areas of the network. Area identification "256" excludes the mobile from operation in any area, i.e. it is in monitor mode only.

Specific operating areas will be designated and identified at a later time.

4.3 ELECTRONIC SERIAL NUMBER

Electronic Serial Number (ESNs) are used as a security measure in mobile and portable units to protect the system from unauthorized use and to help identify stolen equipment. A unique and unalterable ESN must be permanently affixed to the chassis (case) of each individual mobile and portable unit manufactured for use with the Cantel Mobitex Network. Before a mobile unit is accepted by the network, it transmits its electronic serial number (as part of the BORN message) to the network, where it is checked against the serial number stored there in association with the MAN.

The format of the ESN, which is also transmitted as part of ACTIVE and ROAM messages from the mobile, is as follows.



The 32-bit ESN is divided into three fields, with bit 1 the least significant bit (LSB) and a bit 32 the most significant bit (MSB). There is an 18-bit serial numbers field (bits 1-18), a 6-bit reserved field (bits 19-24), and an 8-bit manufacturer's code field (bits 25-32).

The manufacturer's code will be assigned by Cantel. The manufacturers may subdivide their serial number fields for their own convenience; a total of 262,144 combinations are available. The reserved field is for future use to provide additional capability for the serial number of model number representation. Manufacturers may wish to apply for additional ESN space at a later time; until then, the reserved field should be set to zeros.

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The ESN is included in octets 9 through 12 of the BORN, ACTIVE and ROAM messages. The MSB of the ESN is bit 8 of octet 9, and the LSB is bit 1 of octet 12. The ESN must also be furnished by the mobile in an ESNINFO message, in response to an ESNREQ message from the network.

4.4 RADIO FREQUENCIES

This section contains radio parameters (frequency plan, channel numbering and system channels) specific to the Cantel network.

4.4.1 DEFINITION OF FREQUENCY BAND

The frequency band information is the band in which the mobile terminal is working. The Frequency Band Information (FBI) designation for Cantel is:

FBI = 4, which corresponds to 900 MHz and 8k bps.

This information is used by the network when the mobile terminal sends MPAK INFO to the network.

Further Information: R1-09

The base station uses the frequency band information in certain radio frames.

Further Information: R1-16, Appendix A, Frames

4.4.2 DEFINITION OF TERMINAL TYPES

The terminal type information is used to separate terminals with different functionality.

The Terminal Type Information (TTI) associated with Cantel is:

TTI = 3, meaning terminal type 3

This information is used by the mobile terminal when sending MPAK INFO to the network.

Further Information: R1-09

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4.4.3. CHANNEL NUMBERING AND FREQUENCY PLAN

The radio channels used for Mobitex communications between mobiles and base stations are allocated by the DOC from 898-901 MHz band for mobile transmit and from the 935-940 MHz for base station transmit (mobile receive). Each mobile transmit is paired with a base station transmit channel exactly 39 MHz higher in frequency. Thus whenever a base communicates with a mobile, and transmits for example on 936.2625 MHz (Channel 3701, which is the first channel in Group F), the mobile must transmit to that base station only on 897.2625 MHz, which is Channel 581 and is precisely 39 MHz lower in frequency.

Figure F-1 shows the channel number, the base station transmit frequency, and the mobile transmit frequency, within this allocation. It also shows a letter designation indicating the block to which each channel belongs. The channels within any group are spaced exactly 12.5 KHz apart. The frequency of a channel may be calculated by the formula.

$$\text{Frequency in MHz} = 890 + 0.0125 (\text{channel number})$$

Note that the channel numbers given in Figure F1 have been assigned by ERTEL and are known as "Mobitex Channel Numbers". They do not correspond to channel numbers assigned by the DOC or the FCC in the United States. However, since the Mobitex system will communicate frequency information to mobile and portable units by using the Mobitex Channel Numbers, these channel numbers must be recognized and associated with the corresponding frequencies by the units.

It is important to note that although current Cantel MOBITECH frequency plan associates transmit and receive frequencies and channel numbers in fixed pairs (the paired frequencies are 39MHz apart), the design of the mobile unit transceivers should not preclude the use of transmit and receive frequency pairs with various frequency separations. In the future, it is not unlikely that mobile units will be required to operate with transmit/receive frequency pairs selected from any of the allowable frequencies in Figure F1 in order to permit optimization of overall system performance under various circumstances.

4.5 RADIO EQUIPMENT

4.5.1 NATIONAL REGULATIONS

Mobile Terminals must comply with all regulations published by the Department of Communications relating to equipment used in this service. This includes, but is not limited to RSS 122. A manufacturer must design the equipment to or in excess of these radio standard requirements.

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Figure P-1
Channel Numbering Plan

BLOCK	MOBILE	BASE STATION	BLOCK	MOBILE	BASE STATION	BLOCK	MOBILE	BASE STATION
Chan.	Chan.	Chan.	Chan.	Chan.	Chan.	Chan.	Chan.	Chan.
661	890-2425	3781	917-2625	K	681	890-5125	3801	917-2625
662	2750	3782	2750		682	2750	3802	2750
663	2750	3783	2750		683	2750	3803	2750
664	2750	3784	2750		684	2750	3804	2750
665	2750	3785	2750		685	2750	3805	2750
666	2750	3786	2750		686	2750	3806	2750
667	2750	3787	2750		687	2750	3807	2750
668	2750	3788	2750		688	2750	3808	2750
669	2750	3789	2750		689	2750	3809	2750
670	2750	3790	2750		690	2750	3810	2750
671	2750	3791	2750		691	2750	3811	2750
672	2750	3792	2750		692	2750	3812	2750
673	2750	3793	2750		693	2750	3813	2750
674	2750	3794	2750		694	2750	3814	2750
675	2750	3795	2750		695	2750	3815	2750
676	2750	3796	2750		696	2750	3816	2750
677	2750	3797	2750		697	2750	3817	2750
678	2750	3798	2750		698	2750	3818	2750
679	2750	3799	2750		699	2750	3819	2750
680	2750	3800	2750		700	2750	3820	2750
681	2750	3801	2750		701	2750	3821	2750
682	2750	3802	2750		702	2750	3822	2750
683	2750	3803	2750		703	2750	3823	2750
684	2750	3804	2750		704	2750	3824	2750
685	2750	3805	2750		705	2750	3825	2750
686	2750	3806	2750		706	2750	3826	2750
687	2750	3807	2750		707	2750	3827	2750
688	2750	3808	2750		708	2750	3828	2750
689	2750	3809	2750		709	2750	3829	2750
690	2750	3810	2750		710	2750	3830	2750
691	2750	3811	2750		711	2750	3831	2750
692	2750	3812	2750		712	2750	3832	2750
693	2750	3813	2750		713	2750	3833	2750
694	2750	3814	2750		714	2750	3834	2750
695	2750	3815	2750		715	2750	3835	2750
696	2750	3816	2750		716	2750	3836	2750
697	2750	3817	2750		717	2750	3837	2750
698	2750	3818	2750		718	2750	3838	2750
699	2750	3819	2750		719	2750	3839	2750
700	2750	3820	2750		720	2750	3840	2750
701	2750	3821	2750		721	2750	3841	2750
702	2750	3822	2750		722	2750	3842	2750
703	2750	3823	2750		723	2750	3843	2750
704	2750	3824	2750		724	2750	3844	2750
705	2750	3825	2750		725	2750	3845	2750
706	2750	3826	2750		726	2750	3846	2750
707	2750	3827	2750		727	2750	3847	2750
708	2750	3828	2750		728	2750	3848	2750
709	2750	3829	2750		729	2750	3849	2750
710	2750	3830	2750		730	2750	3850	2750
711	2750	3831	2750		731	2750	3851	2750
712	2750	3832	2750		732	2750	3852	2750
713	2750	3833	2750		733	2750	3853	2750
714	2750	3834	2750		734	2750	3854	2750
715	2750	3835	2750		735	2750	3855	2750
716	2750	3836	2750		736	2750	3856	2750
717	2750	3837	2750		737	2750	3857	2750
718	2750	3838	2750		738	2750	3858	2750
719	2750	3839	2750		739	2750	3859	2750
720	2750	3840	2750		740	2750	3860	2750
721	2750	3841	2750		741	2750	3861	2750
722	2750	3842	2750		742	2750	3862	2750
723	2750	3843	2750		743	2750	3863	2750
724	2750	3844	2750		744	2750	3864	2750
725	2750	3845	2750		745	2750	3865	2750
726	2750	3846	2750		746	2750	3866	2750
727	2750	3847	2750		747	2750	3867	2750
728	2750	3848	2750		748	2750	3868	2750
729	2750	3849	2750		749	2750	3869	2750
730	2750	3850	2750		750	2750	3870	2750
731	2750	3851	2750		751	2750	3871	2750
732	2750	3852	2750		752	2750	3872	2750
733	2750	3853	2750		753	2750	3873	2750
734	2750	3854	2750		754	2750	3874	2750
735	2750	3855	2750		755	2750	3875	2750
736	2750	3856	2750		756	2750	3876	2750
737	2750	3857	2750		757	2750	3877	2750
738	2750	3858	2750		758	2750	3878	2750
739	2750	3859	2750		759	2750	3879	2750
740	2750	3860	2750		760	2750	3880	2750
741	2750	3861	2750		761	2750	3881	2750
742	2750	3862	2750		762	2750	3882	2750
743	2750	3863	2750		763	2750	3883	2750
744	2750	3864	2750		764	2750	3884	2750
745	2750	3865	2750		765	2750	3885	2750
746	2750	3866	2750		766	2750	3886	2750
747	2750	3867	2750		767	2750	3887	2750
748	2750	3868	2750		768	2750	3888	2750
749	2750	3869	2750		769	2750	3889	2750
750	2750	3870	2750		770	2750	3890	2750
751	2750	3871	2750		771	2750	3891	2750
752	2750	3872	2750		772	2750	3892	2750
753	2750	3873	2750		773	2750	3893	2750
754	2750	3874	2750		774	2750	3894	2750
755	2750	3875	2750		775	2750	3895	2750
756	2750	3876	2750		776	2750	3896	2750
757	2750	3877	2750		777	2750	3897	2750
758	2750	3878	2750		778	2750	3898	2750
759	2750	3879	2750		779	2750	3899	2750
760	2750	3880	2750		780	2750	3900	2750
761	2750	3881	2750		781	2750	3901	2750
762	2750	3882	2750		782	2750	3902	2750
763	2750	3883	2750		783	2750	3903	2750
764	2750	3884	2750		784	2750	3904	2750
765	2750	3885	2750		785	2750	3905	2750
766	2750	3886	2750		786	2750	3906	2750
767	2750	3887	2750		787	2750	3907	2750
768	2750	3888	2750		788	2750	3908	2750
769	2750	3889	2750		789	2750	3909	2750
770	2750	3890	2750		790	2750	3910	2750
771	2750	3891	2750		791	2750	3911	2750
772	2750	3892	2750		792	2750	3912	2750
773	2750	3893	2750		793	2750	3913	2750
774	2750	3894	2750		794	2750	3914	2750
775	2750	3895	2750		795	2750	3915	2750
776	2750	3896	2750		796	2750	3916	2750
777	2750	3897	2750		797	2750	3917	2750
778	2750	3898	2750		798	2750	3918	2750
779	2750	3899	2750		799	2750	3919	2750
780	2750	3900	2750		800	2750	3920	2750
781	2750	3901	2750		801	2750	3921	2750
782	2750	3902	2750		802	2750	3922	2750
783	2750	3903	2750		803	2750	3923	2750
784	2750	3904	2750		804	2750	3924	2750
785	2750	3905	2750		805	2750	3925	2750
786	2750	3906	2750		806	2750	3926	2750
787	2750	3907	2750		807	2750	3927	2750
788	2750	3908	2750		808	2750	3928	2750
789	2750	3909	2750		809	2750	3929	2750
790	2750	3910	2750		810	2750	3930	2750
791	2750	3911	2750		811	2750	3931	2750
792	2750	3912	2750		812	2750	3932	2750
793	2750	3913	2750		813	2750	3933	2750
794	2750	3914	2750		814	2750	3934	2750
795	2750	3915	2750		815	2750	3935	2750
796	2750	3916	2750		816	2750	3936	2750
797	2750	3917	2750		817	2750	3937	2750
798	2750	3918	2750		818	2750	3938	2750
799	2750	3919	2750		819	2750	3939	2750
800	2750	3920	2750		820	2750	3940	2750
801	2750	3921	2750		821	2750	3941	2750
802	2750	3922	2750		822	2750	3942	2750
803	2750	3923	2750		823	2750	3943	2750
804	2750	3924	2750		824	2750	3944	2750
805	2750	3925	2750		825	2750	3945	2750
806	2750	3926	2750		826	2750	3946	2750
807	2750	3927	2750		827	2750	3947	2750
808	2750	3928	2750		828	2750	3948	2750
809	2750	3929	2750		829	2750	3949	2750
810	2750	3930						

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Figure F-1
Channel Allocation Plan

MOBILE BLACK	Chan.	Freq.	BASE STATION		MOBILE		BASE STATION	
			Chan.	Freq.	Chan.	Freq.	Chan.	Freq.
S. 841	900.5125	3961	939.5125	T. 861	900.7625	3981	939.7625	
842	925.0	3962	35250	862	7750	3982	7750	
843	5375	3963	5375	863	7875	3983	7875	
844	5500	3964	5500	864	8000	3984	8000	
845	5625	3965	5625	865	8125	3985	8125	
846	5750	3966	5750	866	8250	3986	8250	
847	5875	3967	5875	867	8375	3987	8375	
848	6000	3968	6000	868	8500	3988	8500	
849	6125	3969	6125	869	8625	3989	8625	
850	6250	3970	6250	870	8750	3990	8750	

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4.5.2. OUTPUT POWER - MOBILE UNITS

The units must be capable of operating at various power levels as designated by the system in the TXPOW parameter in the <SVP> frame from the network. The required levels are:

OUTPUT POWER	dB BELOW FULL POWER
10 W	0 (Maximum power)
4 W	4
1.6 W	8
0.63 W	12
0.25 W	16
0.10 W	20

The tolerance on output power levels shall be ± 2.0 dB.

4.5.3. POWER CONTROL - MOBILE UNITS

In addition to exercising output power control as mandated by the network in the TXPOW parameter, mobile units must automatically reduce power level maximum output based on the average received signal strength indication (RSSI) from the current base (as measured during the normal system channel monitoring procedure associated with roaming). This is done to prevent front-end overload of base station receivers from mobile units operating in close proximity.

Mobile output power must be automatically reduced, if necessary, based on RSSI values from the current base station system channel, according to the following table:

Average RSSI Range	Maximum Operating Power Allowed	
	Watts	dB below 10 W
RSSI ≤ 24	10	0
24 < RSSI ≤ 28	4	4
28 < RSSI ≤ 32	1.6	8
32 < RSSI ≤ 36	0.63	12
36 < RSSI ≤ 40	0.25	16
40 < RSSI	0.10	20

Values given in the first column of the table must be stored in alterable non-volatile memory to allow for possible future adjustments.

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With regard to automatic power reduction in mobile units, the maximum power output specified by the network on the TXPOW parameter sets an upper limit, but not a lower limit, on the actual output power to be used by the mobile unit.

The maximum effective radiated power (ERP) for a mobile must be limited to 10 watts.

4.5.4 CARRIER ON STATE

The controller shall key the carrier 'on' (i.e. shall apply power to carrier) only when it is ready to transmit a message. The transmitter is ready under two different conditions.

- after switching from receiving to transmit condition, during which the switching time should be less than 20 ms (including CPU handling time)
- When switching from one channel frequency to another, during which the switching time should not exceed 30 ms.

4.5.5 PROTECTION AGAINST FALSE TRANSMISSION

A protection circuit shall be provided to minimize the likelihood that transmitter operation could occur falsely due to a component failure. The protection circuit shall consist of an RF output power detector and a transmitter enable which is entirely independent of the main transmitter on-off control circuit. The RF power detector and a transmitter enable which is entirely independent of the main transmitter on-off control circuit. The RF power detector shall be examined from time to time by the control logic and the radio should be shut down if RF power is detected when the radio is not keyed on.

4.5.6 MOBITECH ACCESS NUMBER (MAN)

The mobile access number will be included in the customer specific PROM, as documented elsewhere in this specification. It will be a 24 bit number that will be specific to the terminal, and will be programmed on at service initiation.

4.5.7 STANDARD ELECTRO-MECHANICAL INTERFACES

It is recommended that radio/modem equipment be designed with standard interfaces to facilitate customer connection of different terminals. If a manufacturer provides a totally integrated unit, this requirement does not apply.

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The modem shall interconnect with the terminal via an RS-232 interface. If the application includes accessory peripherals (such as a printer), such connections shall also be by use of an RS-232 interface.

4.6 TERMINAL TIMEOUTS AND PARAMETER STORAGE REQUIREMENTS

The following timeout values will be in effect for terminal units operating within the Cantel Mobitex network:

4.6.1 POWER-ON DELAY

Delay after power-on or return from 'manual mode':
45 (+/-) 15 seconds.

4.6.2 QUICK SCAN DELAY

Delay after lost contact with base, before the 'quickscan' procedure is activated: 30 seconds.

4.6.3 CONGEST TIME OUT

Timeout on CONGEST state retransmit:
120 seconds.

4.6.4 MAXIMUM REPETITIONS

Maximum number of transmit repetitions (default value of MAX_REP); 5
Note that the current value of MAX-REP is given by the network in the <SVP> frame.

4.6.5 PARAMETER STORAGE REQUIREMENTS FOR MOBILE UNITS

4.6.5 PERMANENTLY STORED/UNALTERABLE

- ESN
- TTY = 3

FBI = 4

- Channel class = 4
- Working method = 2
- Radio Output power = 10
- Radio Tx/Rx Switch Time = (≤ 20)

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4.6.5.2 PERMANENTLY STORED/ELECTRONICALLY ALTERABLE BY AUTHORIZED PERSONNEL

- MAN
- Priority
- Frame Synch Pattern(s)
- Default List
- Roam Scanning Cycle Length = 10
- Congest Time Out = 120
- Quick Scan Initial Delay = 30 sec.
- Power on Delay = 45 sec.
- RSSI Levels for Power Control (=24, 28, 32, 36, 40)

4.6.5.3 DYNAMICALLY ALTERABLE BY MOBILE

- Group List
- Temporary Default List
- Current List
- Die/Live State
- MAX-REP
- Selected Frame Sync. Pattern
- Personal Subscription List
- Current Base Area ID
- Current System Channel
- Packet Sequence Number
- Frame Sequence Number
- Area ID's allowed
- Present Text

4.7 SCANNING PROCEDURES

4.7.1 LISTS OF CHANNELS

The mobile unit uses various lists of radio channels to search for new base radio stations during the roaming procedure. Refer to Chapter 2, Appendix A, for an overview of the roaming procedure.

In order to facilitate the roaming procedure, the unit should have the ability to minimize the total number of radio channels that have to be searched. The following lists of channels are available in the mobile unit for scanning.

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CURRENT-BASE is the base radio station with which the mobile unit is communicating at present, or the one with which it was last in contact.

CURRENT-LIST is received by the mobile unit in the <SVP> frame and contains the system channels used by the neighbouring base radio stations.

DEFAULT-LIST is a list of all system channels used in the network.

TEMPORARY DEFAULT-LIST is an alternative, short list of system channels in the mobile unit's usual (or authorized) operating area.

The choice of which of the two default lists normally used in the mobile unit will be dependent on both the extent of the operating area and the particular application. However, the complete DEFAULT-LIST defined by the network operator should be permanently stored in the mobile terminal, even though it may be seldom used.

4.7.2 ALTERNATIVE PROCEDURES AND MODES

In order to minimize the time during which mobile units are out of contact with a base station, the scanning procedure to be used will vary depending on particular circumstances. Specifically:

1. Base Stations in the area in which the mobile unit is operating may share an area system channel, or each of them may have its own separate system channel.
2. The mobile unit may have contact with a base station, and therefore be using the normal scanning procedure; or it may have lost contact for some time, and therefore be using the quick scanning procedure.
3. For roaming purposes, the system may be operating in FRAME Mode (in which case RSSI measurements are made using frame heads), or in CONTINUOUS MODE (in which case RSSI measurements are initially made on base station carriers that are maintained continuously on).

Details of the normal and quick scanning procedures, and of the FRAME and CONTINUOUS modes of operation are summarized in Appendix A of Chapter 2.

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With respect to case 1 above, the mobile unit must be designed to accommodate scanning of alternative base stations (normal scanning procedure), or searching for new base stations (quick scanning procedure) on the current (or last used) system channel frequency before scanning other channels. It is recommended that this be the first priority scanning operation in the mobile unit.

Next, for either normal or quick scanning procedure, the mobile unit searches the current (neighbour) list of system channels provided by the network in the <SVP> frame. In the case of normal scanning, this search is conducted during the SCAN-Time interval designated in the <SVP> frame.

Finally, for the quick scanning procedure (in case the mobile unit has not yet contacted a base station), either the normal or the temporary default list of system channels is scanned, depending on which has been designated for the mobile unit. During the quick scanning procedure, the unit must return to scan the last used system channel after every ten scans of other channels.

The mode of operation in effect, FRAME or CONTINUOUS, does not alter the scanning sequence. CONTINUOUS mode cannot be used when base stations share an area system channel, but its use where possible will shorten the time required for a mobile unit to re-establish contact with the network after contact has been lost.

While scanning under CONTINUOUS MODE, the mobile must, after finding a carrier with a satisfactory RSSI, acquire and evaluate one or more frame heads to determine whether or not it has found a valid base station. If it has not, scanning continues.

4.7.3. PARAMETERS

The maximum number of channels to be stored in the current (neighbour) list of system channels in the mobile unit is 32.

The maximum number of channels to be stored in the permanent default list of system channels in the mobile unit is 256.

The maximum number of system channels to be stored in the alternative, temporary default list of system channels in the mobile unit is 64.

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Which of the two default lists is to be used by the mobile unit during the quick scanning procedure must be selectable from the application layer.

Further Information: R1-02 (appendix A), R1-08, R1-16, R1-18

4.8. GENERAL DESIGN REQUIREMENTS

4.8.1 COMMON REQUIREMENTS FOR ALL FIXED, MOBILE, AND PORTABLE TERMINALS.

Dimensions:

The manufacturer shall select dimensions of his product.

Weight:

The manufacturer shall select the weight objectives for his product.

Radiation:

Electromagnetic Interference (EMI) radiated from any terminal design must be within the limits specified by the Appropriate DOC regulations.

Storage:

When packaged, all terminals shall be capable of being stored in temperatures of -40 C. to + 65 C. and in humidities up to 90% for temperatures up to 30 C with constant air moisture content at temperatures between +30 C and + 65 C.

4.8.2 ADDITIONAL REQUIREMENT FOR MOBILE TERMINALS.

Radiation Limitations:

Harmonic and Spurious Radiation, Carrier On:

The mean power of harmonic and spurious emissions from the transmitter, as measured at the antenna connector with the transmitter properly terminated, shall be at least 25 microwatts. These emissions shall be measured as defined by Department of Communications publication RSS122 paragraph 7.3.

Radiation with Carrier Off:

With the transmitter keyed off, any emissions from the transceiver, as measured at the antenna connector with proper terminations, shall not exceed 60 dBm in the mobile transmit band, 896-901 MHz or -80 dBm in the mobile receive band 935 to 940 MHz.

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Radiation susceptibility:

The transceiver design and the specification for the associated RF cable connecting to the antenna shall provide sufficient shielding to permit normal operation of the mobile while the internal combustion engine of the car or truck in which it is installed is operating at highway speeds.

4.9 ENVIRONMENTAL REQUIREMENTS

Mobitex terminals must meet the following basic requirements. Section 4.9.1 below describes requirements for mobile units, designed for use in land vehicles and watercraft. Section 4.9 provides the requirements for fixed terminals.

4.9.1 BASIC ENVIRONMENTAL REQUIREMENTS FOR VEHICULAR INSTALLED UNITS

Temperature:

The mobile unit must be capable of operation in the temperature range of -25 C (13F) to + 55 C (131 F). The manufacturer may wish to meet additional extended temperature limits for applications in hot desert or in extreme winter environments. If so, he may specify the extended temperature limits his units are capable of meeting.

Relative humidity:

The terminal must be capable of operation at relative humidities between 5% and 100% of temperatures below 30 C (86 F) and between 5% and 90% at temperatures between 30 C. and 55 C.

NOTE:

Since relative humidity in a test chamber cannot be controlled with high accuracy, testing will be performed at humidities of 5% and 90%. While no attempt will be made to set the humidity above 90%, the manufacturer should recognize that at times during temperature cycling water in humid air will condense on the terminal and, unless hermetically sealed, on the circuit boards within the terminal. The terminal must be capable of operation with water from humid air condensed on it and in it.

4.10 MASC INTERFACE ERROR MESSAGES (to be supplied later)

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5. DOCUMENTATION AND REVISION CONTROL

Each manufacturer shall maintain documentation of his terminal products and subassemblies. He must maintain records of revisions and waivers, if any, applicable to the equipment he produces, together with a record of the model designation, serial numbers, or production codes affected by any such revision or waiver. Where subassemblies or modules are procured from other vendors the manufacturer may either keep his own records applicable to the procured subassembly of module or require his vendor to do so.

6. QUESTIONS AND ANSWERS

From time to time, manufacturers will question Cantel concerning specification matters. All such questions will be answered by Cantel and the question and answer distributed to all registered holders of this specification. Such questions and answers should be filed in this section of the specification. They will be numbered so that directions to destroy certain questions and answers can be sent with updates to other section of the specification.

6.1 Question:

How does one know the length of an MPAK? That is, the MPAK doesn't have any field stating the length?

Answer:

Mobitex radio protocol.

Here the frame length is stated in the primary block. In this block one field states the number of blocks following the primary block.

Line protocol

As an example we use HDLC (and LAPB).

In these protocols, the start and the end of a frame is indicated by special flags (predefined bit combinations). If a receiver wants to know the length of a received frame, this is done by counting the number of bytes between the start and end flags.

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APPENDIX A

Frequency Utilization for Mobitex

The minimum C/I requirement for the Cantel Mobitex network is 15 dB for a 1.2 kbit/s data channel and 18 dB for an 8 kbit/s channel. Compared to the C/I requirement of 17 to 18 dB for a voice channel which is generally applied to an 800 MHz cellular system, it is possible that the frequency reuse pattern for the Mobitex network can be derived with reference to that of a cellular network.

Most cellular systems have employed the standard AMPS channelling plan which permits the same group of radio frequencies to be reused in a specific pattern. With the typical 7-site reuse pattern ($N = 7$), it is generally possible to achieve a C/I protection ratio of 18 dB in an urban environment.

If we apply the $N = 7$ frequency reuse plan to the Mobitex system, it is apparent that there will be some excessive system margin during the initial implementation of our system operating at 1.2 kbit/s. However, since our 1.2 kbit/s system will shortly be augmented by the 8 kbit/s system which requires more stringent C/I requirement, frequency planning for the Mobitex network should consider the worse case (i.e., 8 kbit/s system).

Since the C/I requirement for the Mobitex 8 kbit/s system is almost the same as that of a cellular system, Mobitex can virtually be regarded as a cellular system for frequency planning and coverage planning purposes. Taking account of the need to minimize the use of the radio spectrum and yet ensure adequate C/I protection to guard against co-channel interference, an $N = 7$ frequency reuse pattern is recommended.

The $N = 7$ frequency reuse pattern to be used for the Mobitex network is slightly different from that commonly seen in a cellular system, i.e., a 7/21 plan (7 cells/21 sectors). In the 7/21 plan, a minimum of three channels are required to be arranged in sectors within a cell.

For the Mobitex network, omnidirectional antennas will be used at most of the base station sites and sectorized arrangements will be avoided as far as possible. This will help to minimize the requirement for spectrum allocation. There will be the cases where special engineering efforts (e.g., proper siting and positioning of the base station antenna) will be needed to meet the C/I requirement.

Based on an $N = 7$ frequency reuse pattern, the following frequency assignment plan for 12.5 KHz channelization of the 900 MHz trunking band is proposed:

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BASE TX FREQUENCY

1	$F1 + 0.25N$
2	$F1 + 0.25N + 0.025$
3	$F1 + 0.25N + 0.050$
4	$F1 + 0.25N + 0.075$
5	$F1 + 0.25N + 0.100$
6	$F1 + 0.25N + 0.125$
7	$F1 + 0.25N + 0.150$

Where F1 is the base Tx frequency (within the frequency range 935 MHz to 940 MHz) for the common system channel and N = 1, 2, 3, etc.

The corresponding base Rx frequency is 39 MHz below the Base Tx frequency [i.e., Base Rx frequency - Base Tx frequency - 39 (MHz)].

This frequency plan is based on an equi-spaced channelling arrangement with a minimum Tx/Tx separation of 250 KHz. It is necessary to maintain a minimum Tx/Tx separation of 250 KHz for satisfactory performance of the transmitter combiner. We consider this type of plan desirable to limit any possible Intermodulation products to within the Mobitex system itself instead of causing potential problems to other radio systems, while at the same time reducing combining losses.

Cantel has been assigned a national system channel; BASE Tx: 939.9875, Base Rx: 900.9875, and the following local channels:

[939.9875,900.9875],	[939.7500,900.7500],	[939.7375,900.7375],
[939.7250,900.7250],	[939.5000,900.5000],	[939.4875,900.4875],
[939.4750,900.4750],	[939.2500,900.2500],	[939.2375,900.2375],
[939.2250,900.2250],	[939.2125,900.2125],	[939.0000,900.0000],
[938.9875,899.9875],	[938.9750,899.9750],	[938.9625,899.9625],

The frequency band 896-901/935-940 MHz (901-902/940-941 MHz is frozen) has 400 channels (12.5 KHz channel width) available, in 10 blocks with block sharing between Canada and USA, and 40 channels per block. (Only the Base Rx band is shown)

<u>BLOCK</u>	<u>40 CHANNEL BLOCK</u>
1	896.0 to 896.5
2	896.5 to 897.0
3	897.0 to 897.5
4	897.5 to 898.0
5	898.0 to 898.5
6	898.5 to 899.0
7	899.0 to 899.5
8	899.5 to 900.0
9	900.0 to 900.5
10	900.5 to 901.0

MTS A.2

Date: 25-Jul-90

Original Project ET/SYSC STT	Engineering Support/Program ET/SYSC STT	No. 2 2/1056 - A 296 5171/02 Ue
Designer/Designer Description/Approved ET/SYSC STT STT	Design Date 1990-02-20 G	P. No. MTS08.2
Background Cantel Mobitex		Title MOBITEX Application layer for terminals
<p style="text-align: center;"><u>ABSTRACT</u></p> <p style="text-align: center;">This document specifies the application layer for terminals to be connected to the MOBITEX network.</p>		
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1 INTRODUCTION

1.1 GENERAL

The application layer is the network's face to the users. This is where the user and the terminal designer have almost unlimited possibilities to adapt the terminals and use the network for many different applications.

In this specification, all layers above the network layer are considered as the application layer.

The application layer has been specified as little as possible. The minimum which has been decided upon is necessary for users to be able to quickly recognize and use common functions in the different types of terminals.

Most of the functions stated on the application level are only recommendations and can be used as required by the terminal manufacturer.

Of course, the terminals should be easy to handle and should permit the communication which the user of the equipment may require.

For the lowest of the application layers, the Transport Layer, separate recommendations are being considered. Among other things, these recommendations will deal with the handling of messages longer than 512 octettes (sequence numbering between terminals of sub-messages and the rearranging of received sub-messages into correct order before delivery to upper layers).

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2 FUNCTIONS IN THE APPLICATION LAYER

The application layer is the user interface. The only functions where requirements and recommendations are specified are:

- addressing of messages,
- choice of status message,
- emergency traffic,
- personal subscription interface,
- presentation of network messages,
- manual radio mode,
- manual activation of mobile terminals,
- flow control,
- network identification number,
- area identification number and
- radio channel lists.

For other areas we recommend that terminal designers develop functions according to user requirements.

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2.1 ADDRESSING OF MESSAGES

A message contains the information which the user wishes to transfer, supplemented with information which is necessary for the message to reach the correct subscriber in the network.

There is a number of different methods of addressing a MOBITEK message between user and terminal. These methods can be divided up and designated in the following manner:

- * Number dialling:
 - MOBITEK subscription number (MAN)
 - abbreviated number
 - default number
 - number sequence
 - alternative dialling
- * Other addressing methods:
 - special keys
 - letter combinations (e.g names)
 - direct addressing with MAN from connected application equipment.

Each terminal which is connected to MOBITEK shall permit one or more of the methods above. The terminals which permit number dialling in any form shall also permit manual dialling with complete MOBITEK subscription numbers (MAN).

When presenting senders for messages received, MAN shall always be shown to the user. Either separate or parallel with one of the above address types.

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2.1.1 GENERAL INFORMATION ABOUT NUMBER DIALLING

All number dialling is recommended to comply with the following principle:

NO + FUNCTION + TERMINATOR

NO is a number of one of the following types:

- MAN 1-8 digits
- abbreviated number a few digits, ended by numbering character #.
- number sequence several optional numbers, separated by a comma ', ', asterisk '*' or semicolon ';'
- default number no number given - FUNCTION/TERMINATOR given directly.

FUNCTION and TERMINATOR comprises of one or more predetermined key strokes. FUNCTION terminates the NO input and selects the function to be used (e.g. status message, text message or speech call). Additional information (e.g. status number or text message) is entered after FUNCTION and is terminated by TERMINATOR. TERMINATOR normally initiates the transmission (e.g. SEND button). For predetermined messages, FUNCTION and TERMINATOR can be combined in the same key.

2.1.2 NUMBER DIALLING/PRESENTATION WITH MAN

If a terminal allows any form of number dialling, the terminal shall also permit number dialling with MAN.

MAN shall be stated and presented in decimal form.

The sender's MAN shall be presented for each message to the user. This can be separately or in parallel with another address type.

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2.1.3 NUMBER DIALLING WITH ABBREVIATED NUMBERS

Recommendation:

Terminals with number dialling can offer the user the option of using abbreviated numbers. Abbreviated numbers are defined locally in each terminal.

An abbreviated number is distinguished by the terminating character '#'.
 An abbreviated number is usually one or two digits.

Abbreviated numbers are not supposed to start with one or more zeros.

2.1.4 NUMBER DIALLING WITH DEFAULT NUMBERS

Recommendation:

A terminal can offer the user a very quick and simple addressing method - default numbers.

When using default numbers, the terminal is designed so that it interprets the lack of address (NO) in the message as a certain predetermined address.

The predetermined numbers can be either one default number per FUNCTION or a general default number for all FUNCTIONS.

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2.1.5 NUMBER DIALLING WITH NUMBER SEQUENCE**Recommendation:**

Terminals which are connected to MOBITEX can permit addressing with number sequence. This means that the users can address one and the same message to several independent addressees.

When a number sequence is used, the terminal sends a message with an address list (refer to reference RI-09).

Note that the use of a number sequence when requesting a speech connection (connection request) is not permitted.

All types of numbers which the terminal allows for separate number dialling shall also be permitted for number sequence. Conversion to MAN shall take place in the normal way.

If another addressing principle is permitted, e.g. name, we recommend that these addresses are also permitted in the number sequence.

Addresses in the number sequence shall be separated by a comma ',', asterisk '*' or a semicolon ';'.

The number sequence is terminated by FUNCTION.

Note that two separation characters in sequence shall be interpreted as the default number for the relevant FUNCTION - if default numbers are available.

2.1.6 NUMBER DIALLING WITH OTHER NUMBERS

Types of numbers other than those stated above may be used. Different types of internal company numbers belong to this category.

These numbers must also follow the number dialling procedure (NO + FUNCTION) and shall be converted to MAN in the application layer.

2.1.7 OTHER ADDRESSING PRINCIPLES

A number of methods for addressing messages between user and terminal may be used in addition to those stated above.

B.4.4.1

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2.1.8 SPECIAL KEYS

Recommendation:

Terminals can be fitted with special keys each of which represent a MAN, or with keys which generate predetermined messages addressed with MAN, etc.

2.1.9 LETTER COMBINATIONS

Recommendation:

The user can store MAN for a number of different users in the terminal and then select MAN for a message by writing the receiver's name with letters.

2.1.10 DIRECT ADDRESSING FROM CONNECTED APPLICATION EQUIPMENT

Recommendation:

The addressing of messages can take place automatically in the application equipment if such equipment is connected to the terminal.

We recommend that such addressing be carried out with MAN according to the format which is specified in relation to lower layers. If MAN is used, no further conversion is necessary.

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2.2 STATUS MESSAGES

Messages which are often repeated such as "I'M AVAILABLE", "I'M ENGAGED", "I'M OFF TO LUNCH" etc. can be coded as status codes. Such status codes constitute information in status messages.

The advantage of a status message is that it is transmitted much quicker than the corresponding text messages.

The MOBITEK network can transmit 256 different status codes in such status messages. Which status codes are to be used, and what they mean, are defined in each terminal.

The status message type of traffic is recommended for all types of terminal which are connected to MOBITEK.

2.2.1 CHOICE OF STATUS CODE

The method of selecting a status code can vary somewhat between different terminals. We recommend that one or more of the following methods be used from a terminal:

- A) Direct dialling with special status keys, which generate addressed status messages with predetermined status code (normal address and status code generated by status key).
- B) Dialling with special status keys which generate predetermined status messages without addresses. Addressing is carried out according to the normal addressing method (NO + FUNCTION + TERMINATOR where FUNCTION + TERMINATOR are combined in the relevant status key).
- C) Dialling with decimal (or possibly hexadecimal) status code and normal addressing.

Initial zeros need not be entered before a decimal status code.

The user's procedure when sending status messages shall be as near as possible to that used for other types of messages.

Alternative A means a significant simplification of the procedure.

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It is recommended that the terminal is able to present both the translated status code and the decimal status code (simultaneously or alternatively). This makes it possible to use one and the same terminal within different terminal groups with different definitions of status codes.

For terminals which are used within several such groups, we recommend that a further simplification of the procedure be made by the terminal converting the status code in accordance with different code keys depending on which sender the message has.

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2.3 EMERGENCY TRAFFIC

Emergency traffic normally means the following in terms of the user:

- sending emergency signals from mobile terminals (mobile terminal subscription or personal subscription logged-in to mobile terminal),
- receiving emergency messages in a fixed terminal,
- sending an emergency acknowledgement from a fixed terminal and
- setting up an emergency line connection between the receiving fixed terminal and the alarming mobile terminal.

However, the network operator decides how the emergency service should be launched, i.e. which subscription types to generate and receive emergency messages. It could also be possible to manage this on an individual subscriber basis.

2.3.1 EMERGENCY SIGNAL

An emergency signal which is normally sent from a vehicle contains dynamic information. The form of this dynamic information component is defined in the network layer.

The dynamic information contains current data about the user. This data may have been stored for a longer period in the mobile terminal, it may have been accessed from peripheral equipment and/or may have been entered at the terminal short time before sending the emergency signal.

The dynamic information may contain a maximum of 256 alphanumeric characters from the 'MOBITEX text code' (see reference R1-06 for definition). The source of the emergency signal may also be indicated (see reference R1-19 for definition).

Each line of the dynamic information may normally contain a maximum of 80 characters. There must not be more than 10 lines of dynamic information.

The lines are separated from each other with a carriage return (CR) followed by a line feed character (LF).

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2.3.2 EMERGENCY MESSAGES

An emergency message which reaches an emergency receiver contains the dynamic information (i.e. the emergency signal) as well as the static information component which is stored in the network together with information about the addressee of the emergency message.

The static information contains general data about the sender, the terminal etc. which may be of interest in an emergency. The contents shall be compiled through collaboration between the sender and the addressee of the emergency message.

The storage of static information for emergency messages is handled in MOBITEK by network operators in accordance with the subscriber's wishes. The users are responsible for their emergency information being correct and current.

The static component of the emergency information may normally contain a maximum of 256 characters from the 'MOBITEK text code' (see reference R1-06 for definition).

The emergency message should not consist of more than 512 characters. Each line in both the static and dynamic information components may contain a maximum of 80 characters. There must not be more than 20 lines in both these components together.

The lines are separated from each other by a carriage return (CR) followed by a line feed character (LF).

The fixed terminals receiving the emergency message shall be able to print out the message in plain text, according to 'MOBITEK text code' (see reference R1-06 for definition).

When an emergency message is received at a terminal, the user is to be informed of this immediately. It is then optional whether the emergency message is to be presented directly in its entirety or whether the sender is to request the message manually.

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2.3.3 EMERGENCY ACKNOWLEDGEMENT

The emergency acknowledgement is sent from the receiving terminal to the sender of the emergency signal.

The emergency acknowledgement is generated after having been initiated manually.

The MOBITEK network does not carry out any monitoring or control that the emergency message is followed by an emergency acknowledgement.

The procedure for generating an emergency acknowledgement shall comprise a function selection followed by a suitable terminator.

FUNCTION SELECTION + TERMINATOR

Note that this procedure shall always be carried out manually for security reasons.

The emergency acknowledgement can be presented in a suitable manner in the alarming terminal.

2.3.4 EMERGENCY CONNECTION

A line connection for speech can be set up between the emergency receiving terminal and the alarming terminal (an emergency connection).

Any automatic generation of an emergency connection in conjunction with an emergency acknowledgement can be solved in the respective application. The network interprets the emergency acknowledgement and the emergency connection as two separate procedures.

2.3.5 EMERGENCY DISCONNECTION

A mobile terminal involved in a one way emergency connection with the transmitter on, i.e. silent emergency connection, shall turn the transmitter off for five seconds each minute to be available for disconnection or other packets and to prevent the transceiver from being turned off after 10 minutes. The 10 minutes refers to the control circuit, which prohibits the continuous transmission of carrier for longer periods than 10 minutes, see reference R1-18.

Checklist

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2.4 PERSONAL SUBSCRIPTION INTERFACE

2.4.1 PASSWORD

When a personal subscription is requested to be logged-in, a password must be entered, for the network to accept the subscriber. The password also shows that the operator is authorized to use the personal subscription.

Since the password constitutes the key to the personal subscription, it is in the user's interest to keep his password secret.

A password can consists of up to 8 alphanumeric characters. The permitted characters in the network are: the upper case letters A-Z and numbers 0-9. It is recommended that terminals convert lower case letters (a-z) in passwords to upper case.

The form of the password between terminal and network is described in the network layer.

(In addition to this type of password the terminal can of course have local passwords which are never sent to the network).

2.4.2 LOGGING IN PERSONAL SUBSCRIPTIONS

A personal subscription can be used in traffic after the order for log-in is approved. After cancelling the log-in, the subscription is deactivated.

2.4.3 LOG-IN PROCEDURE

The procedure for logging in a personal subscription in respect of the user follows the procedure below:

FUNCTION SELECTION + MAN + TERMINATOR + PASSWORD + TERMINATOR

'MAN' in this context is the personal subscriber's MAN.

It is recommended that the password cannot be read from the terminal to safeguard the user's interest. Asterisks or similar can be printed out instead.

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2.4.4 LOG-OUT PROCEDURE

The procedure of logging out a personal subscription is similar to the log-in procedure, except that the password is left out.

FUNCTION SELECTION + MAN + TERMINATOR

'MAN' in this context is the personal subscription's MAN.

2.4.5 NETWORK ORDER TO LOG OUT A PERSONAL SUBSCRIPTION

When a terminal logs out a personal subscription, ordered by the network, the user should be informed about this.

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2.5 PRESENTATION OF NETWORK MESSAGES

Messages, except user traffic sent from the network, can be network orders or information. It can also be a message earlier sent by the user and for any reason returned by the network.

In reference R1-06 national requirements, such as language and identification number, made on the presentation is defined.

These messages should be presented with the information given in the traffic state, described in reference R1-09.

Please note the presentation when receiving messages or signals described below.

Note: Incoming packets with traffic state CONGEST are allowed to be retransmitted, but not within a given timeout (reference R1-06).

2.5.1 NETWORK INFORMATION AND ORDER MESSAGES

DTESERV:LIVE/DIE.

If a DIE is received, or the user tries to send user traffic when a DIE is received, this should be shown to the user.
It should also be shown to the user when the terminal has received a LIVE, and can resume sending of user traffic.

Signal:SPEECH_QUEUE_INFO.

This is a signal created by the link layer. The meaning of the signal is that no speech channel is immediately available, and the speech connection request is placed in a queue. The signal contains the speech queue number for the request. Both that the request is queued and the queue number, should be presented to the user.

Signal BASE_LOST.

This is a signal created by the link layer. The meaning of the signal is to show to the user that contact with the base radio station is lost and no messages can be transmitted.

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Signal BASE_CONTACT.

This is a signal created by the link layer. The meaning of the signal is to show to the user that contact with the base radio station is established again.

2.5.2 RETURNED MESSAGES AS "NOT TRANSMITTED"

A message indicated as a "not transmitted" message, i.e. there is no acknowledgement of the message from the network, should be presented as described below and required in reference R1-09.

General: The message is presented as a "not transmitted" message. The meaning of "not transmitted" shall be apparent during the presentation.

PSUECOM: As "General".

PSOSCOM: As "General".
 The application decides if the message shall be presented or not, e.g. send the message to the link layer again.

CSUBCOM: As "General".
 The disconnection is presented as a reaction of the "not transmitted" message. A line connection request can have the indication "not transmitted" when the lower layer has received a "NAT-frame".

DTESERV:LOGINREQ/LOGOUT:
 As "General".
 The personal subscription is to be considered as logged-out by the terminal.

DTESERV:SOSRX/VICESOSRX.
 As "General".

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2.6 MANUAL RADIO MODE

Mobile terminals may have the ability to switch over to manual radio mode, e.g. to be used in another network. Before leaving MOBITEK mode and entering manual mode the terminal shall transmit an INACTIVE packet. This is equivalent to the procedure at power-off described in reference R1-09. Before the manual radio mode is entered, the INACTIVE packet should be acknowledged. The terminal should wait 15-20 seconds for the acknowledgement, before entering the manual radio mode.

When the terminal leaves manual radio mode and returns to MOBITEK mode, an ACTIVE packet shall be transmitted according to the procedure at power on, described in reference R1-09.

Note: There are no other requirements made on "Manual radio mode" in the MOBITEK TERMINAL SPECIFICATION, than the requirements made in this chapter.

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2.7 MANUAL ACTIVATION OF MOBILE TERMINALS

Mobile terminals may have the ability to transmit an ACTIVE packet, in order to activate themselves in the network.

This could, for example, be used when the terminal has resumed contact with the network after having been out of radio coverage. The network may have inactivated the terminal during this time, because no traffic have been possible to transfer to the specific terminal.

Normally, an automatic activation is sent to the network after a certain delay-time, specified in reference R1-06. This procedure could be replaced by a manual activation, if the activation delay is considered to be too long.

This activation must be manual, i.e. by operator command.

After power-off, an INACTIVE packet should be sent by the terminal. Before the terminal is switched off, the INACTIVE packet should be acknowledged. The terminal should wait 15-20 seconds for the acknowledgement, before switching off.

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2.8 FLOW CONTROL

MOBITEX is a connection-less, packet-switched, type of network, that uses store-and-forward technique. Complete messages, small or large, are transferred between end-users without establishing any connections.

The end-users are connected to the network via different protocols and bit rates. In order to avoid congestion and buffering problems in the terminals of the end-users, it is recommended that the application layer of the terminals should include a protocol for data flow control. This could be compared to the XON/XOFF-handling of other asynchronous communications and would give a smoother control of the data flow than if it was included in the protocol of lower layers. It will also alert the subscriber to what is happening.

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2.9 NETWORK IDENTIFICATION NUMBER

In order to make it possible for a mobile terminal to change between different networks, the terminals should have this ability. This will make it possible to:

- have different MOBITEK networks existing in the same area and in the same frequency band,
- prevent mobile terminals from unnecessarily changing between networks (no automatic change of network).

The network operator decides, in reference R1-06, if terminals should have the ability to roam into and traffic different MOBITEK networks. If that is the case, there should be a possibility for the operator of the mobile terminal to manually change network, by selecting a new network identification number.

The network identification number plan, i.e. the identification number of each network is defined in the document "Network Operator Information" (reference R1-06).

A network identification number can consist of up to 6 digits. There are a number of different methods of selecting a new network, e.g. number dialling, special keys or letter combinations (network names). Please, see chapter "Addressing" in this document.

The selected network identification number should then be transferred to the physical layer, to be used in the signalling with the network.

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2.10 AREA IDENTIFICATION NUMBER

Area identification numbers (area IDs) are used to specify geographical areas. Such an area is denoted as a traffic area and is given a unique area ID by the network.

A list of area IDs specify the area a mobile terminal may traffic. Outside the specified area, two possible cases exist:

- 1) the terminal is not operational
- 2) the terminal is operational, but may be debited a different fee.

When a subscription is registered, the traffic area a mobile terminal may operate, is defined. These area IDs are registered in the network subscription record for each mobile terminal. Information about valid area IDs and whether the terminal should be operational or not outside the traffic area, is transferred to the mobile terminal in a packet via the radio path.

If the terminal should not be operational outside the subscribed traffic area, it should be shown to the user that the mobile has left its traffic area and is not operational. As well, the user should be told when the mobile terminal is within its traffic area again.

Should the terminal be operational, the user must still be notified that the mobile has left its traffic area and might be debited differently. The user should then be told when the mobile terminal is within its normal traffic area again.

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2.11 RADIO CHANNEL LISTS

The mobile terminals uses a list of radio channels, defined in document "Network operator information" (reference R1-06, chapter "Scanning procedures"), to search for new base radio stations (roaming procedure).

In order to speed up the roaming procedure, the terminal may have the possibility to shorten the channel list. This could be done from the application, either manually by the user or automatically (e.g. as in the second example below). This shortened list is called temporary default list, and is used by the link layer instead of the permanent default list. It should also be possible to change or delete the temporary list from the application.

For example, if the mobile terminal uses a very restricted traffic area, only those channels applicable to the present traffic area are required to be used by the roaming procedure.

Another example is to let the information about which traffic area (area ID) the mobile terminal is within, control which channels to be used by the roaming algorithm.

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3 INTERFACE WITH LOWER LAYERS

Lower layers shall notify whether a message has not been transferred to the network.

All addressing shall be converted to the MOBITEK subscription number (MAN) in respect of a subordinate layer.

For line connection handling, the signals HOOK-OFF and HOOK-ON shall be available to the network layer. These signals indicate whether and when the operator is ready to start and to finish a conversation. They are used to change the line-connection mode in lower layers.

3.1 DATA MESSAGES WITH HIGHER PROTOCOL IDENTIFICATION

A packet of type "HPDATA" in MOBITEK network protocol, has a field for protocol identification number. This indicates the type of higher protocol used, i.e. a protocol above the network layer.

The size of the protocol identification number in HPDATA is one octet. This octet shall be coded

<u>decimal value</u>	<u>indication</u>
0	no protocol identification
1-127	reserved for public protocols
128-255	free to be defined for the subscriber application

Public protocols means protocols that have been registered and assigned a protocol identification number by the network operator (reference R1-06).

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4 MOBITEK SUBSCRIPTION NUMBER (MAN) IN THE TERMINALS

In MOBITEK each subscription and group is allocated a number of up to 8 digits (decimal). These allocations are called MOBITEK subscription numbers or 'MAN' and state the destination and origin of all traffic in MOBITEK. MAN shall always be stated when addressing between network and terminal. The designations which are used between user and terminal shall always be converted to MAN between terminal and network.

Each terminal shall be capable of addressing messages to, as well as receive messages from, all MANs in the decimal number series 0 - 16,777,215.

The terminal shall allow messages to be received for subscriptions connected to the terminal as follows:

- 1 MAN for the terminal's own subscription,
- 1 MAN for the All Terminals Group *),
- 14 MANs for optional individual group subscriptions and
- 7 MANs for personal subscription.

all together 23 different MANs.

- *) All terminals in MOBITEK will belong to one common group, the All Terminals Group MAN, dedicated MAN number 7. This should be loaded into the terminal by the network in the group list, sent on the reception of BORN.

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5 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 12, 13, 17, 20, 22, 24, 25
RI-09, 8, 17, 18, 19
RI-18, 14
RI-19, 12

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
RI-01	Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

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REQUIREMENT SPECIFICATIONS 1(44)

System Name ET/SYS GCn	Functional Requirements ET/SYS GCn	No. 56 5/1056 - A 296 5171/2 Ue	
Document Name: The requirements ET/SYSC STT <i>Sir</i>		Date: Date 1990-02-22	Rev. File A MTS09.2
Summary Cantel Mobitex™		Title MOBITEX Network layer for terminals	
<p><u>ABSTRACT</u></p> <p>This document describes the network layer for terminals connected to the Mobitex system.</p>			
<p>Illustrations</p> <p>Diagram</p>			

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1 INTRODUCTION

The specification of the network layer for the terminals connected to the MOBITECH network comprises four documents. These documents are:

- Main document
- Appendix A, Packet formats
- Appendix B, Dialogues
- Appendix C, Logical description

The purpose of the different sections of the documents is:

- Chapter 1 Is a brief introduction to the documents.
- Chapter 2 States the packet classes and the packet names which are relevant to the terminals.
- Chapter 3 Defines the general structure of the relevant data packets. (Refer also to Appendix A).
- Chapter 4 Defines how data packets are used for dialogue between terminal and network. (Refer also to Appendix B).
- Chapter 5 States the set of data packets, that is relevant for each type of terminal.
- Chapter 6 Defines which parameters that should be stored at power off for a terminal.
- Chapter 7 Defines which parameters that should be transferred to the data link layer.
- Appendix A Together with Chapter 3 this provides an illustration of the individual data packet's structure.
- Appendix B Together with Chapter 4 this provides an illustration of the dialogues between terminal and network.
- Appendix C Shows the interaction between modules within the network layer, as well as between the network layer and the data link layer and the application layer. It also contains a logical description of the network layer.

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1.1 THE NETWORK LAYER IN BRIEF

Communication between the terminal and the MOBITEK network has been divided into layers according to the model described in "General description of terminals".

The network layer is the layer which is closest to the application layers. All communication through interfaces and external connections must be checked against the given set of rules for the network layer. All attempts to send something that does not comply with these rules should be prohibited.

1.2 PROTOCOLS BETWEEN TERMINAL AND NETWORK IN BRIEF

When a terminal user sends a MOBITEK message the terminal creates a data packet which it sends to the network. The data packet should contain the information which the user wishes to transfer, supplemented with information which is necessary for the message to reach the correct subscriber in the network.

Since data transmission is controlled by lower layers, traffic transmission in the network layer is carried out through negative acknowledgement.

This means that the message is not normally acknowledged. The sender is notified however if the message has not reached the addressee for any reason. In a situation like this, the message is returned to the sender with an indication of the cause of the fault.

Messages to groups are excepted from the principle of negative acknowledgement. It would be a very impractical procedure to use any type of acknowledgement for these messages since the groups can be of considerable sizes.

All data packets to be switched between terminals and networks must follow the structures and procedures stated in this specification.

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2 PACKETS

MOBITEX is a packet switching network which also allows real time connections between subscribers.

There are two different types of traffic principles used in MOBITEX :

- Packet switched traffic which is transmitted according to the 'store-and-forward principle.
- Circuit switched traffic, used for real time connections between terminals.

2.1 PACKET CLASSES AND PACKET NAMES

2.1.1 Packet switched traffic

In the packet switched traffic in MOBITEX, data packets are used to :

- Transferring information from one subscriber to another subscriber.
- Connecting a circuit switched connection between subscribers thus permitting the transmission of speech or other information, e.g. circuit switched data;
- updating information which is stored in networks and terminals.

2.1.2 Circuit switched traffic

Circuit switched traffic, i.e. traffic which is exchanged over a real time connection is treated briefly in this document.

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Data packets in MOBITEK are divided into a number of packet classes. The four packet classes which are relevant to the terminal's communication with the MOBITEK network are:

- | | |
|--|-----------|
| - Packet switched subscriber communication | - PSUBCOM |
| - Packet switched emergency communication | - PSOSCOM |
| - Circuit switching for subscriber and emergency communication | - CSUBCOM |
| - Data terminal service communication | - DTESERV |

2.1.4 Transmission direction

In the following sections the normal transmission direction(s) for each data packet is given. The direction is stated by: to/from terminal, to terminal or from terminal.

Note that a packet can also be sent in the opposite direction but this concerns a packet that can be not be transferred and is returned to the sender.

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2.2 PACKET SWITCHED SUBSCRIBER COMMUNICATION

Data packets which transfers information from one subscriber to another subscriber through the MOBITEK network are included in the packet-switched subscriber communication.

Internal traffic:

Packets which are included in this group are transferred between subscribers in MOBITEK.

TEXT	text messages	to/from terminal
DATA	data messages	to/from terminal
STATUS	status messages	to/from terminal
HPDATA	data message with higher protocol identification	to/from terminal

External traffic:

Packets included in this group are switched between a subscriber in an external telecommunication network connected to MOBITEK and a subscriber in MOBITEK who also subscribes to the relevant telecommunications network.

EXTPAK	messages from/to external networks	to/from terminal
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2.3 PACKET SWITCHED EMERGENCY COMMUNICATION

There are certain packets which are used for emergency traffic.

Emergency traffic:

Packets included in this group can be switched with high priority on the radio path between MOBITEK subscribers.

SOS	emergency signal	to/from terminal
SOSINFO	emergency messages	to terminal
SOSACK	emergency acknowledgement	to/from terminal

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2.4 CIRCUIT SWITCHING FOR SUBSCRIPTION AND EMERGENCY COMMUNICATION

Data packets are included in circuit switching for subscription and emergency communication, in order to establish and disconnect a real time connection.

The data packets in this class are used for communication between network and terminal.

Circuit switched connections:

Packets which are included in this group are used for establishing circuit switched connections to be used for analogue signals such as speech or for real time data communication, e.g. normal modem.

CONREQ	connection request	to/from terminal
CONFAST	connection request fast	to/from terminal
CONGRA	connection request granted	to terminal
LINSEL	line selected	from terminal
CONORD	conn. order for group call	to terminal
CONREA	ready for connection	from terminal

Emergency connections:

Packets in this group initiate priority emergency connections to terminals. These emergency connections permit speech or transfer of circuit connected data between MOBITEK subscribers.

Emergency connections are given priority over other circuit switched connections.

SOSCONREQ	emergency connection request	to/from terminal.
SOSCONFAST	emergency connection request fast	to/from terminal.

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External connections:

Packets in this group establish a real time connection between a connected telecommunications network and a terminal. These external connections permits speech or circuit connected data between a MOBITEK subscription and a subscriber in an external network, e.g. the public telephone network.

EXTCONREQ external connection request to/from terminal

Connections with additional information:

Packets in this group establish real time connections. The packet contains additional information which can be used for stating internal additional numbers (extensions) for other terminals.

ADDCONREQ connection request with additional information to/from terminal

ADDCONFAST connection request with additional information fast to/from terminal

Disconnection:

Packets in this group disconnect the real time connection to the terminal.

DISCON disconnection of connection to/from terminal

Line test:

Packets in this group are used for test of a real time connection between the terminal and the network.

CLOOPON circuit loop test start to terminal
CLOOPOFF circuit loop test end to terminal

Line barring:

Packets in this group are used to bar and open line connections.

LINEOFF line connection barring from terminal

LINEON line connection opening from terminal

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2.5 DATA TERMINAL SERVICE COMMUNICATION

The data terminal service communication includes data packets which transfer information between subscription/terminal and network.

The information transferred by these packets update the data in the terminal or network. This data is necessary for traffic switching in the network.

Subscription state:

Packets in this group change the status of personal subscriptions in the system.

LOGINREQ	login request	from terminal
LOGINGRA	login request granted	to terminal
LOGINREF	login request refused	to terminal
LOGOUT	logout	from terminal
LOGOUTORD	logout order	to terminal

Terminal status:

Packets in this group change the network's information about the status of the terminal.

BORN	terminal active for the first time	from terminal
ACTIVE	terminal active	from terminal
INACTIVE	terminal not active	from terminal
DIE	terminal is not permitted to send user traffic	to terminal
LIVE	terminal permitted to send user traffic again	to terminal
ROAMORD	roaming order	to terminal
ROAM	roaming message	from terminal
VICESOSRX	re-direction of emergency messages	from terminal
SOSRX	cancel emergency re-direction	from terminal

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Terminal information:

Packets in this group transfer terminal information between the terminal and the network.

GROUPLIST	list of group MAN	to terminal
FLEXREQ	list of personal subscription MAN requested	to terminal
FLEXLIST	list of personal subscription MAN	to/from terminal
INFOREQ	terminal information requested	to terminal
INFO	terminal information	from terminal
TIME	time information	to terminal
AREALIST	list of valid area IDs	to terminal
ESNREQ	Electronic Serial Number requested	to terminal
ESNINFO	Electronic Serial Number information	from terminal

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3 PACKET FORMATS

The packets which are used in the Mobitex network layer are given the common designation MobitexPacket, or MPAK. MPAK is used in all communication between the subscriptions and the network.

An MPAK must never be more than 560 octets long.

3.1 STRUCTURE OF MPAK

This chapter describes the structure of that part of MPAK which is common to all types of packets sent to and from terminals. The part which can vary according to different types of packets is described later.

The design of each individual packet that can be used with a terminal is described in APPENDIX A.

Each MPAK is divided into different parts according to the following:

- Common component which is included in all MPAK.
- Address list which is included in certain types of MPAK. The MPAK with the address list is formed by the terminal and sent to the network. The network copies the common component and type dependent component of such an MPAK, forms new MPAK and sends these to the addressees in the address list.
- Type dependent component which is included in certain types of MPAK. The size and application depends on the packet concerned.

The contents of the different fields in each component are described on the following pages.

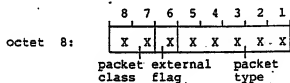
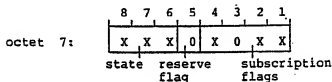
Section:

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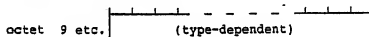
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Common component of MPAK:



Any type-dependent part:



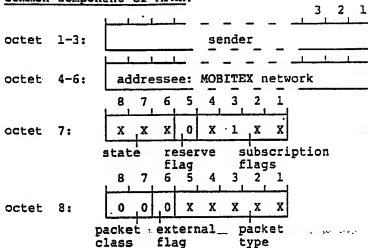
(X = optional 0 or 1)

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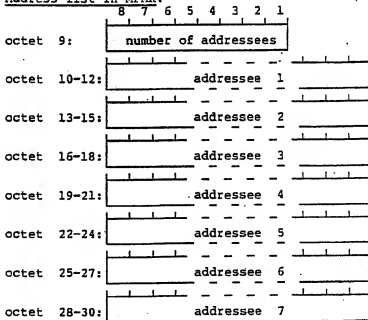
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3.1.2 MPAK with address list

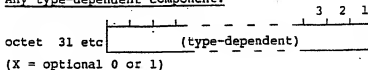
Common component of MPAK:



Address list in MPAK:



Any type-dependent component:



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3.2 COMMON COMPONENT

The common component of MPAK is included in all data packets which are used between terminal and network.

3.2.1 Sender

Sender: (octet 1-3)

The sender is the subscription or the network which originally generated the packet.

The sender's MAN is given in binary code in 3 octets.

The sender MAN can be a terminal subscription MAN, a personal subscription MAN or a network MAN.

3.2.2 Addressee

Addressee: (octet 4-6)

The addressee is the subscription, group or network which was originally intended as the receiver - the original destination.

The addressee's MAN is given in binary code in 3 octets.

The addressee MAN can be a terminal subscription MAN, a personal subscription MAN, a group MAN or a network MAN.

Note: The SENDER and ADDRESSEE fields always indicate the original sender and addressee, i.e. the content of the fields are not swapped in returned messages.

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3.2.3 Traffic State

Traffic state (octet 7, bit 6-8)

The packet's traffic state is stated with 3 bits and can have the decimal values 0-7.

A packet can have one of the following eight states:

State = 0 OK

Meaning: 'OK'
 No problems have occurred during the switching.

Action: Present the message to the user (please refer to reference R1-08). The traffic state need not be stated.

State = 1 FROM_MAIL

Meaning: 'From mailbox'.
 This message is coming from the network mailbox.

Action: This message is presented in the same way as other incoming messages (please refer to reference R1-08). It should also be presented to the user, at what time the message was placed in the mailbox. The meaning of the state should be apparent from the presentation.

State = 2: IN_MAIL

Meaning: 'Has been placed in the mailbox'.
 The addressee cannot be reached at the moment. This message has been placed in the network mailbox.

Action: This returned message copy is presented in the same way as other incoming messages (please refer to reference R1-08). In certain cases, the presentation of text and data in the type dependent component can be omitted. The meaning of the state should be apparent during the presentation.

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State = 3: NO TRANSFER

Meaning: 'The addressee can not be reached'. This message cannot be transferred or put in the network mailbox.

Action: This returned message is presented in the same way as other incoming messages (please refer to reference R1-08). In certain cases, the presentation of text and data in the type-dependent component can be omitted. The meaning of the state should be apparent during the presentation.

State = 4: ILLEGAL

Meaning: The message could not be switched by the network.

Action: This returned message is presented in the same way as other incoming messages (please refer to reference R1-08). In certain cases, the presentation of text and data in the type-dependent component can be omitted. The meaning of the state should be apparent during the presentation.

State = 5 : CONGEST

Meaning: Line or radio channels are congested.

Action: This returned message is presented in the same way as other incoming messages (please refer to reference R1-08). In certain cases, the presentation of text and data in the type-dependent component can be omitted. The meaning of state should be apparent during the presentation.

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State = 6: ERROR

Meaning: 'Technical error'.
 The message cannot be transferred because of a technical error.

Action: This returned message is presented in the same way as other incoming message (please refer to reference R1-08). In certain cases, the presentation of text and data in the type-dependent component can be omitted. The meaning of the state should be apparent during the presentation.

State = 7: BUSY

Meaning: The B-party is busy with real time connection.

Action: This returned message is presented in the same way as other incoming messages (please refer to reference R1-08). In certain cases, the presentation of text and data in the type dependent component can be omitted. The meaning of the state should be apparent during the presentation.

Note: As states 2, 3, 4, 5, 6 and 7 indicate returned messages but the SENDER and ADDRESSEE fields have not been swapped, the SENDER field should be used for match with the terminal's own MAN:s for these states (message returned to original sender).

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3.2.4 Subscription Flags

Subscription flags: (octet 7, bit 1-4)

A subscription/terminal can raise a number of flags in the common component of MPAK. A flag is raised when its contents will apply. Flags can be raised independently of each other.

A flag is raised when its logic value is 1 and lowered when its logic value is 0.

Flag 1: MAILBOX_F (octet 7, bit 1)

MAILBOX_F = 0 : Must not be placed in the network mailbox.

MAILBOX_F = 1 : May be placed in the network mailbox.

Flag 2: DIGITAL_F (octet 7, bit 2)

DIGITAL_F = 0 : Digital route not required.

DIGITAL_F = 1 : Digital route required.

Flag 3: SENDLIST_F (Octet 7, bit 3)

SENDLIST_F = 0 : Address list is not included.

SENDLIST_F = 1 : Address list included.

Flag 4: UNKNOWN_F (octet 7, bit 4)

UNKNOWN_F = 0 : Normal position

UNKNOWN_F = 1 : Subscription not here.

Reserve flag: (octet 7, bit 5)

This flag is reserved until further notice.

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3.2.5 Packet class

Packet class: (octet 8, bit 7-8)

This field states the class to which the packet belongs by 2 bits in the common component of MPAK. The packet class can have the decimal values 0-3.

The four classes are:

Packet class = 0: PSUBCOM
 Packet class = 1: PSOSCOM
 Packet class = 2: CSUBCOM
 Packet class = 3: DTESERV

3.2.6 External Flag

External flags: (octet 8, bit 6)

The external flag is raised to indicate that the packet is being used in traffic with an external network.

This flag must be lowered to indicate internal traffic in MOBITEK.

EXTERN_F = 0 : Internal traffic
 EXTERN_F = 1 : External traffic

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3.2.7 Packet Type

Packet type: (octet 8, bit 1-5)

Each packet name corresponds to a packet type together with a position on the EXTERN_F flag. (Refer to 'Packet classes and packet name' for more details).

Packet types are stated with 5 bits in this field. Packet types can have the decimal values 0-31.

The following types of packets are used for terminals:

Within packet class = 0, i.e. PSUBCOM:

EXTERN_F=0:	packet type=1:	TEXT
	packet type=2:	DATA
	packet type=3:	STATUS
	packet type=4:	HPDATA
EXTERN_F=1:	packet type=1:	EXTPAK

Within packet class = 1, i.e. PSOSCOM:

EXTERN_F=0:	packet type=1:	SOS
	packet type=2:	SOSINFO
	packet type=3:	SOSACK

Within packet class = 2, i.e. CSUBCOM:

EXTERN_F=0:	packet type=1:	CONREQ
	packet type=2:	ADDCONREQ
	packet type=3:	CONGRA
	packet type=4:	CONORD
	packet type=5:	CONREA
	packet type=6:	DISCON
	packet type=7:	CLOOPON
	packet type=8:	CLOOPOFF
	packet type=9:	LINEON
	packet type=10:	LINEOFF
	packet type=11:	CONFAST
	packet type=12:	ADDCONFAST
	packet type=13:	LINSEL
	packet type=17:	SOSCONREQ
	packet type=27:	SOSCONFAST
EXTERN_F=1:	packet type=2:	EXTCONREQ

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Within MPAK packet class = 3, i.e. DTESERV:

EXTERN_F=0:

packet type= 1:	LOGINREQ
packet type= 2:	LOGINRA
packet type= 3:	LOGINREF
packet type= 4:	LOGOUT
packet type= 5:	LOGOUTORD
packet type= 6:	BORN
packet type= 7:	ACTIVE
packet type= 8:	INACTIVE
packet type= 9:	DIE
packet type=10:	LIVE
packet type=11:	ROAMORD
packet type=12:	ROAM
packet type=13:	VICESOSRX
packet type=14:	SOSRX
packet type=15:	GROUPLIST
packet type=16:	FLEXREQ
packet type=17:	FLEXLIST
packet type=18:	INFOREQ
packet type=19:	INFO
packet type=20:	TIME
packet type=21:	AREALIST
packet type=22:	ESNREQ
packet type=23:	ESNINFO

Packets not listed above are reserved.

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3.3 ADDRESS LIST

If an address list is included after the common component of the MPAK, this should be stated with a raised flag 'SENDLIST_F' in the MPAK common component.

An address list must always begin at octet 9 and end at octet 30.

Note that the address list always has a length of 22 octets, irrespective of how many addresses will be read by the network.

The address list should be designed as shown in chapter 'MPAK with address list'.

The field 'number of addresses' states how many of the following 7 address fields that are valid. The MAN for the respective subscription should be stated in the 7 address fields.

Empty address fields should be filled with zeros when creating the address list.

A packet with address list is returned to the sending terminal if the packet type is not allowed or if an error occurs before the network has unpacked the address list.

3.4 TYPE-DEPENDENT COMPONENT

If an address list is included in MPAK, the type-dependent component begins with octet 31 otherwise it begins with octet 9 directly after the common component of MPAK.

Further information on the type dependent fields is given for the respective packet in Appendix A.

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4 PROTOCOL

Some of the packets which the terminal sends to the network should be distributed to another subscriber. Other packets have the network as destination.

Each terminal should be capable of storing a specified number of MOBITEK subscription numbers (MAN). These MAN are divided into MAN for terminal subscription, MAN for groups and MAN for personal subscriptions.

Only packets which are sent to terminals and which have one of all the terminal's subscriptions as addressee or sender will be handled. These packets are the only ones which may be notified to the user. If any other packet reach the network layer, it should be sent back to the network with Subscription flag UNKNOWN_F = 1. See chapter 4.5.2 Flags.

All interchange of packets between terminal and network should be according to a protocol. This chapter describes the protocols for the dialogues which occur in the network layer between the terminal and network in general terms.

Appendix B describes each dialogue separately. The dialogues are divided into a number of groups which on the whole agree with the division of packets into packet classes.

All packets which are referred to in this chapter are referred to in PACKET CLASS AND PACKET NAME and their structures are defined in PACKET FORMATS and APPENDIX A.

4.1 TRAFFIC HANDLING PRINCIPLES

Packets are normally not acknowledged on the network layer level. However, the sender is informed if a packet has not reached the addressee. In this case, the packet is returned to the sender with an indication of the cause of the fault. The fault is given in the traffic state field of the packet.

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4.2 ACTIVATION/INACTIVATION

In order to avoid transmission attempts to terminals which cannot be reached, an activation/inactivation procedure is included in the terminals.

Inactivation :

The terminal should inactivate itself by automatically transmitting an INACTIVE packet to the network

- 1) before it is powered off.
- 2) when the terminal's message buffer is full and the terminal is incapable of handling more packet from the network.

A terminal may also be inactivated by the network. This occurs if the network has repeatedly failed to reach the terminal with traffic.

The terminal and its personal subscriptions are then regarded as inactive by the network until it receives an ACTIVE packet from the terminal. When a subscription is inactive, traffic to it is forwarded to the network mailbox or returned to the sender without attempt to reach the terminal. Messages are stored in the network mailbox according to the principle described in chapter 'MOBITEX NETWORK MAILBOX' in this document.

If contact is lost during the attempts to transmit the INACTIVE packet no further attempts are made. If contact is already lost when INACTIVE should be sent, no transmission at all is attempted.

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MTS09.2**Activation :**

The terminal should activate itself by automatically transmitting an ACTIVE packet to the network :

- 1) When it is switched on.
- 2) When the terminal's message buffer has space for at least 6 messages of maximum length.
- 3) When the data link layer in the mobile terminal indicates that the terminal should activate itself. This case arises when the data link layer has lost contact with the base radio station, and the contact is re-established with the same base station again.
- 4) On order from the application layer.

It is also possible to insert a delay time before sending the ACTIVE packet to the network. If user traffic from the terminal is generated during this delay period, the transmission of the ACTIVE packet could be omitted.

Two different delays are defined :

- 1) Activation delay after power-on.
- 2) Activation delay after lost contact with the network.

Requirements on these delays are specified in the Network operator information, please see R1-06.

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4.3 EMERGENCY TRAFFIC

The handling of emergency traffic can be given priority in the network and should also be given priority in terminals.

When an emergency message reaches a terminal, the user should immediately be given clear notice that the emergency message has arrived. It may also be possible for the message to interrupt another activity so that it can be presented immediately in its entirety.

When an emergency signal is initiated; the sending of the emergency signal from the terminal should be given priority over the sending of other messages. Assume that the user have ordered the terminal to send a text message. An emergency message is initiated by the user at the same time as the text message is to be transmitted. In this case the transmission of the text message should be interrupted, and the emergency message should be transferred.

4.4 MOBITEK NETWORK MAILBOX

Terminal and personal subscriptions can subscribe to the Mobitex network mailbox facility.

If the addressee of a message can not be reached by the network, the message can be stored in the network mailbox. A message is stored in the network mailbox if :

- 1) the sender of the message indicates so by using the subscription flag MAILBOX_F
- and
- 2) the addressee subscribes to the mailbox service.

If the message is stored in the mailbox, a copy of the message will also be returned to the sender with traffic state IN_MAIL.

When the subscription is activated or have finished a real time connection, the packets which have been placed in the mailbox are sent to the subscription. If the packet had traffic state OK when it arrived at the mailbox, the traffic state of the packet has changed to FROM_MAIL when it is sent from the mailbox to the subscription. Packets with traffic states other than OK will pass the mailbox with an unchanged traffic state.

Otherwise there is no change in the contents of the packet.

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4.5 CIRCUIT SWITCHED CONNECTION

A circuit switched connection in MOBITEK is a real time connection which is primarily used for speech connections. A circuit switched connection may also be used for circuit switched data.

Circuit switched connections are always bi-directional. The base stations operates in duplex. The mobile terminals operates in two-frequency simplex or duplex communication mode.

There are two different methods of requesting a line connection, by using MPAK :

- 1) CON**R (CONREQ, ADDCONREQ, SOSCONREQ, EXTCONREQ)
- or
- 2) CON**F (CONFAST, ADDCONFAST, SOSCONFAST)

If a line connection is initiated with a CON**R from the A-party, the network requires that the B-party terminal informs the network when HOOK-OFF is done by sending a CONREA packet. If the line connection is initiated with a CON**F, no CONREA should be sent to the network. This means that the line connection is established when the B-party has successfully received the CON**F packet. Please refer to Appendix A for description of packet formats and to Appendix B for line connection dialogues.

Three different protocols are used for circuit switched connection :

- Prot_1: Is used in mobile terminals and fixed terminals with one line for real time connection.
- Prot_2A: Is used in fixed terminals with several lines for real time connections. The network selects lines for real time connections.
- Prot_2B: Is used in fixed terminals with several lines for real time connections. The terminal selects lines for real time connections.

For more information about differences between Prot_2A and Prot_2B see appendix A and appendix B.

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4.6 THE USE OF FIELDS IN THE COMMON COMPONENT IN MPAK

This section gives a guideline how the fields in the common component in MPAK are to be used. The structure of the fields are defined in chapter 'PACKET FORMATS' in this document.

4.6.1 Traffic states

In a mobile communication network, certain situations can arise when the network cannot transfer the message.

The traffic state field is used by the network to inform the terminal or subscription of the state of each individual packet. The reason for returning a packet to the terminal is stated in the traffic state field.

Returned packets originating from an MPAK with address list can be returned without address list if the network has already formed the individual-messages, otherwise the original MPAK with address list is returned.

- In each data packet only one traffic state can be indicated in the traffic state field.
- The traffic state relates only to the packet in which it is stated.
- A data packet will always have traffic state OK when it is generated by a terminal.
- The terminal must never change the traffic state of a packet.

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4.6.2 Flags

The terminal should be capable of raising a number of flags in the common component of the MPAK. The terminal has no reason to read what are known as subscription flags for the incoming messages. External flags however are of interest to the terminal.

- Flags are raised independently of each other.
- A flag is raised when its logic value is 1 and lowered when its logic value is 0.

MAILBOX F

is used by the terminal to indicate whether the network is allowed to store the packet in the network mailbox if the packet cannot be forwarded to the addressee. MAILBOX F can be raised by a terminal when ordered by the user, or by default.

DIGITAL F

is used by the terminal to indicate that a digital route is required for the requested circuit switched connection. DIGITAL F should not be used when requesting circuit switched connection to groups. DIGITAL F can be raised by the terminal when ordered by the user.

NOTE :

DIGITAL_F should always be set = 0.

SENDLIST F

indicates that the packet includes an address list. This means that the network will create a copy of MPAK common component and MPAK type-dependent component, addressed to each addressee in the address list when the packet enters the network. The network considers each copy as an independent packet generated by the sender. SENDLIST F is raised by the terminal when the sender gives several addresses for a message.

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UNKNOWN F

If the addressee (or the sender in case of returned packets, traffic states 2, 3, 4, 5, 6 and 7) is not in the terminal's list of subscriptions, the terminal raises this flag and returns the message to the sender. UNKNOWN F is therefore raised for a very specific error situation.

Exception: In case this error occurs for a CONREQ, ADDCONREQ, SOSCONREQ, EXTCONREQ, CONFAST, ADDCONFAST or a SOSCONFAST packet it must not be returned to the network. Instead, a DISCON packet should be sent to the network with the UNKNOWN_F flag set.

EXTERN F

Is raised to indicate that the packet refers to traffic with an external telecommunication network, connected to MOBITEX.

RESERV F

Should always be set = 0, until further notice.

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4.6.3 When generating MPAK

The fields in the common component of the MPAK will be used according to the following for all packets generated by the terminal. There are restrictions concerning the sender and addressee. These restrictions are described at the presentation of each individual packet in appendix A.

Sender:

The sender is the MAN which originally sent the message. The MAN may denote a terminal subscription or a personal subscription logged-in to the terminal.

Addressee:

The addressee is the MAN of the originally intended final receiver of the packet. The MAN may denote a terminal subscription, a personal subscription, a group, the MOBITEX network or an external network.

Traffic state:

The traffic state is always = OK

Flags:

MAILBOX_F:

- optional for a number of packets (see Appendix A),
- lowered for all other packets.

DIGITAL_F:

optional for a number of packets (CONREQ, ADDCONREQ, SOSCONREQ, EXTCONREQ, CONFAST, ADDCONFAST and SOSCONFAST), lowered for other packets.

NOTE :

DIGITAL_F should always be = 0.

SENDLIST_F:

- Optional for TEXT, DATA, HPDATA and STATUS
- lowered for other packets.

UNKNOWN_F:

- lowered when generating a packet.

EXTERN_F:

- raised if the addressee is an external network.
- otherwise it is lowered.

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4.6.4 When receiving MPAK

Data packets can be received by terminal at one of the following occasions:

1) Normal case :

the packet is sent to the addressee, MAN match with ADDRESSEE field

2) Returned packets from network :

the packet is returned to the original sender, MAN match with SENDER field. (The packet was returned by the network since it could not be transferred to the addressee)

3) Packets to unknown subscriber in terminal :

the received packet is addressed to a subscriber that is unknown to the terminal. This may occur if the packet was addressed to a personal subscription that has logged-out at the instant the packet was received.

1) Normal case :

In the normal case the message is transferred from the sender to the addressee. In this case the MPAK common component is as follows :

Sender:

The terminal subscription, personal subscription or network MAN which originally created the packet.

Addressee:

One of the possible MAN:s of the receiving terminal (terminal subscription, personal subscription or group).

Traffic state:

OK or FROM MAIL. (The latter applies if the packet has been stored in the network mailbox).

Flags:

EXTERN_F is raised if this is an external packet.

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2) Returned packets from the network :

In this case, the packet was originally generated from one of the terminal's subscriptions but for some reason it has been returned by the network. The reason for the network to return the packet is stated in the traffic state field.

Returned packets must not be sent back to the network, but should be presented to the application layer.

Sender:

The original sender of the packet, which in this case is one of the subscriptions of the terminal (terminal or personal subscription).

This field should be used to find an address match with one of the subscriptions at the terminal.

Addressee:

The originally intended receiver of the packet. Normally a subscription MAN, group MAN or network MAN different from the MAN:s of the terminal. It should not be used to find an address match.

Traffic state:

One of the following:

- IN MAIL
- NO TRANSFER
- ILLEGAL
- CONGEST
- ERROR
- BUSY

Flags:

When SENDLIST_F is set, the returned packet contains an address list and must be treated accordingly.

3) Packets to unknown subscriber in the terminal

If the addressee matching procedure mentioned in case 1) and 2) above fails, the packet should be returned to the network with the UNKNOWN_F flag raised. No other changes in the packet is allowed. Please refer to chapter 'When returning MPAK to the network' in this document.

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4.6.5 When returning MPAK to the network.

When returning a MPAK to the network the following rules apply:

Sender:

Unchanged.

Addressee:

Unchanged.

Traffic state:

Unchanged.

Flags:

The UNKNOWN_F flag should be raised by the terminal returning the packet.

All other flags must be unchanged.

Exception: In case a CONREQ, SOSCONREQ, ADDCONREQ, EXTCONREQ, CONFAST, ADDCONFAST or a SOSCONFAST packet is received under the circumstances described here, it must not be returned. Instead, a DISCON packet should be sent to the network with the UNKNOWN_F raised.

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4.6.6 MPAK returned by the link layer.

In this case the packet is returned by the link layer to the network layer. The reason for this could be that the link layer has lost contact with the network. It must be noted that the packet may have been successfully received by the network, but the acknowledgement from the network to the terminal has been lost.

Sender:

The original sender of the packet.

Addressee:

The originally intended receiver of the packet.

Traffic state :

Not changed.

Flags :

No flags has been changed by the link layer.

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Returned packet from the link layer should be considered as 'not transmitted' and must be treated as follows:

PSUBCOM: The message is indicated as a "not transmitted" message, and sent to the application layer.

PSOSCOM: The message is indicated as a "not transmitted" message, and sent to the application layer.

CSUBCOM: The message is to be considered as a disconnection of the actual line connection.
The message is indicated as a "not transmitted" message, and sent to the application layer.

DTESERV:LOGINREQ/LOGOUT: The message is indicated as a "not transmitted" message, and sent to the application layer.

DTESERV:ACTIVE/INACTIVE: The message is indicated as a "not transmitted" message, and sent to the application layer.

DTESERV:SOSRX/VICSSOSRX: The message is indicated as a "not transmitted" message, and sent to the application layer.

4.6.7 MPAK returned by the network layer to the application layer

When the network sends MPAK DIE the terminal is prevented from sending any user traffic.

The network layer in terminal should notify the application layer when it receives a DIE packet. Packets sent from the application layer when the network layer is in the DIE state should be returned to the application layer.

The DIE state is valid until the network layer in the terminal receives a LIVE packet from the network. The LIVE packet should also be presented to the application layer in order to indicate that user traffic is allowed to send.

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4.7 MESSAGE BUFFERS IN TERMINALS

The terminal must have a buffer for received, but unread messages. This buffer must be able to store at least 6 messages of maximum length.

If the buffer becomes full, an INACTIVE packet should be sent to the network. Traffic to the terminal will then be directed to the network mailbox or returned to the sender.

When the buffer is full this should also be presented to the user.

When there is space for at least 6 new messages, then an ACTIVE packet should be sent. Normal traffic between the terminal and the network is then resumed.

4.7.1 Emergency traffic-buffers

Terminals should always have enough memory space both for generating and receiving emergency traffic.

4.7.2 Sending traffic while buffer is full

The application may send any user traffic (PSUBCOM), while the buffer is full. The terminal should, however, send an INACTIVE packet immediately afterwards.

But when an emergency packet is initiated, this emergency packet should be transmitted immediately without sending an INACTIVE afterwards.

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4.8 ELECTRONIC SERIAL NUMBER (ESN) CHECK

Electronic Serial Number (ESN) check will protect subscribers from unauthorized use of terminals.

The following packets includes the ESN :

BORN
ROAM
ACTIVE

To request the ESN from the terminal two MPAK are included :

ESNREQ
ESNINFO

Fixed terminals without the ESN check function should also use the BORN and ACTIVE packets as defined in this specification. Please see RI-06 for ESN requirements for fixed terminals.

The definition of the ESN format in the packets are described in RI-06.

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5 RELEVANT PACKETS FOR FIXED AND MOBILE TERMINALS

Each terminal type should be capable of receiving all packets without any malfunction.

The absolute minimum required of a terminal to be approved for connection to MOBITEX is that it is capable of handling the following packets in a correct manner:

mobile terminal:
 DTESERV.BORN
 ACTIVE
 INACTIVE
 DIE
 LIVE
 ROAMORD
 ROAM
 GROUPLIST
 INFOREQ
 INFO
 TIME
 AREALIST
 ESNREQ
 ESNINFO

fixed terminal:
 DTESERV.BORN
 ACTIVE
 INACTIVE
 DIE
 LIVE
 GROUPLIST
 TIME

If personal subscriptions are permitted the following packets must also be handled :

DTESERV.LOGINREQ
 LOGINRA
 LOGINREF
 LOGOUT
 LOGOUTORD
 FLEXREQ
 FLEXLIST

If emergency traffic is permitted the following packets must also be handled :

PSOSCOM.SOS
 SOSINFO

optional to emergency receivers:

PSOSCOM.SOSACK
 DTESERV.VICESOSRX
 SOSRX

Sidebars

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If line connection is permitted the following packets must also be handled :

CSUBCOM.CONREQ
 CONFAST
 SOSCONREQ
 SOSCONFAST
 ADDCONREQ
 ADDCONFAST
 EXTCONREQ
 CONREA
 DISCON
 CONORD

optional for fixed terminal

CSUBCOM.CLOOPON
 CLOOPOFF
 LINEON
 LINEOFF

additional for fixed terminal according to PROT_2A
 CSUBCOM.CONGRA

additional for fixed terminal according to PROT_2B
 CSUBCOM.LINSEL

Handling of packets in the class PSUBCOM depends on the the application and are optional :

PSUBCOM.TEXT
 DATA
 STATUS
 HPDATA
 EXTPAK

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6 PARAMETERS TO BE STORED AT POWER OFF

The following network layer parameters are to be stored also during power off in order to be available immediately at power on:

- terminal subscription MAN and Electronic Serial Number (ESN) should be stored permanently in such a way that they are impossible to change by software or by unauthorized persons.
- current status originating from the reception of DIE or LIVE packets,
- list of current group MAN:s (GROUPLIST),
- list of personal subscriptions currently logged-in to the terminal (FLEXLIST).
- list of area IDs (AREALIST)

Note: At power up it is recommended that the stored information in the network layer are controlled against a checksum. If the checksum is found to be incorrect a BORN packet should be sent to the network in order to update the information.

7 PARAMETERS TO BE TRANSFERRED TO THE DATA LINK LAYER

The following network layer parameters are to be transferred to the data link layer :

- list of current group MAN:s (GROUPLIST),
- list of area IDs (AREALIST)

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8 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 27, 40
R1-08, 17, 18, 19

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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REQUIREMENT SPECIFICATIONS 1(118)

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Drawn/Checked/Drawn/checked ET/SYS STT 577		Drawn Date 1990-02-19 A	Rev. No. MTS09A.2
Description Cantel Mobitex		Title MOBITEX Network layer for terminals Appendix A. PACKET FORMATS	
<p>ABSTRACT</p> <p>This document describes the structures of all data packets which are used between terminals and the MOBITEX network. The criteria for generating the packets and actions to be taken when receiving packets are also described for each individual data packet. Mobitex data packets are denoted MPAK (Mobitex Packets).</p>			
<p>Sidebars</p> <p>Report</p>			

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7 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST118

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1 INTRODUCTION

1.1 GENERAL

Fields that appear in the type dependent part of several packet types are defined in chapter 2 in this document.

Chapter 3 - 6 gives a detailed description of each individual MPAK in the PSUBCOM, PSOSCOM, CSUBCOM and DTESERV classes, respectively.

Documents in this section:

- Main document contains a general description of the packet structure and a detailed specification of the common part of the packets.
- Appendix A provides an individual description of the structure of each MPAK.
- Appendix B provides an illustration of the dialogues between the terminal and the network where MPAK are used.
- Appendix C contains a description of the interaction between modules within the network layer, as well as the interaction between the network layer and the data link layer and application layer. It also contains a logical description of the network layer in the mobile terminal.

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2 FIELDS COMMON TO SEVERAL TYPE DEPENDENT COMPONENTS

The following fields appear in the type dependent components of several packet types.

MAN: 3 Octets used as subscription number. The MAN is in the range of 0-16,777,215 decimal, with restrictions according to the specification in reference R1-06.

MAN will always be binary coded as 24 bits, grouped in 3 octets.

Example:

MAN 12345678 (decimal) is the same as BC614E hexadecimal. The binary code will be:

	8	7	6	5	4	3	2	1	
octet 1:	1	0	1	1	1	1	0	0	(Hex: BC)
octet 2:	0	1	1	0	0	0	0	1	(Hex: 61)
octet 3:	0	1	0	0	1	1	1	0	(Hex: 4E)

number of MAN: 1 octet.

connection identity: 1 octet.
(0-255 decimal)

Description: Selected by the A party for the connection. The connection identity is cyclically incremented by one from 1 to 255. Connection identity 0 implies that the packet is relevant irrespective of current connection ID. Only fixed terminals with more than one line for line connections and the MOBITEK network can generate packets with connection identity equal 0. Please refer to appendix B.

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line number: 1 octet
(0-255 decimal)
Description: Used for line connection. Line number 0 is used by mobile terminals and fixed terminals with only one single line for line connection. For fixed terminals with more than one line for line connections, the line number corresponding to each specific line must be defined at the installation of the terminal to the network.

protocol identification number: 1 octet
(0-255 decimal)
Selected by A-party.
Description: This field indicates that an end-to-end protocol, i.e. a protocol above the network layer, between A-party and B-party is in use.

0 decimal means no protocol identification.

1-127 decimal means that a protocol is in use. The protocol identification number is administered by the network operator. A terminal should not use protocol identification numbers between 1-127 without having registered the number at the network operator.

128-255 decimal as protocol identification number may be used by a terminal without restrictions.

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time: The time field should be cleared (0) when sending from a terminal. The time is inserted when the packet enters the first node in the network. The time indication can be used by the receiving terminal when receiving the MPAK.

The time in MOBITEK is given as 'MOBITEK minute' in 3 octets, indicating how many minutes have elapsed since 1985-01-01 00:00 (MOBITEK Local Time).

The following algorithm is used to calculate MOBITEK local time from the 'MOBITEK minute':

```
hour = ( MOBITEK_minute MOD 1440 ) DIV 60
minute = ( MOBITEK_minute MOD 1440 ) MOD 60
MD = MOBITEK_minute DIV 1440
MT=
(4291+10*(MD-(36525*((100MD+30690)DIV36525))DIV 100))DIV10
year = 1984 + ( 100*MD + 30690 ) DIV 36525 + MT DIV 429
month = ( 100*MT ) DIV 3061 - 1 - 12*( MT DIV 429 )
day = MT - ( ( 100 * MT ) DIV 3061 ) * 3061 ) DIV 100
```

In the expressions above, DIV stands for whole number division and MOD for the rest of the whole number division (7 DIV 3 = 2 and 7 MOD 3 = 1).

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Example :

Assume that time indication is 876241 decimal (0D5ED1 hexadecimal). The field for time indication then looks as follows:

	8	7	6	5	4	3	2	1	
octet 1:	0	0	0	0	1	1	0	1	(Hex: 0D)
octet 2:	0	1	0	1	1	1	1	0	(Hex: 5E)
octet 3:	1	1	0	1	0	0	0	1	(Hex: D1)

In this example, the variables will have the following values:

hour = 12

minute = 1

MD = 608

MT = 307

year = 1986

month = 9

day = 1

Thus the time is 1986-09-01 12:01

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3 PSUBCOM

This chapter describes all "packet switched subscriber communication" packets.

3.1 TEXT (text message) without address list:

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or group.

Raised flags:

Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the text information.

The network's normal action when receiving the packet

The network dispatches the packet to the designated address.

The terminal's normal action when receiving the packet

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference R1-08.

Length of the packet:

The length can vary between 12 and 523 octets.

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Doc. Date 1990-02-19 File: A File: FTS09A.2

TEXT without address list as generated by a terminal

MPAK-COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

--	--	--	--	--	--	--	--

octet 4-6:

--	--	--

 addressee

--	--	--	--	--	--	--	--

octet 7:

0	0	0	0	0	0	0	X
---	---	---	---	---	---	---	---

octet 8:

0	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-11:

--	--	--

 time

--	--	--	--	--	--	--	--

octet 12: etc

--	--	--	--	--	--	--	--

 text (max. 512 octets)

(X = optional 0 or 1)

text: 1-512 octets.
According to 'MOBITEX text code'.

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3.2 TEXT (text message) with address list:

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

The network is stated in the ordinary addressee field.

The intended message receivers are stated in the address list. The address list contains a list of subscription numbers, each of which can designate a terminal subscription, a personal subscription or a group. Compare with the ordinary addressee field in 'TEXT' without address list.

Raised flags:

Requirement: SENDLIST_F

Optional : MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the text information to a number of designated addressees.

The network's normal action when receiving the packet:

The network will make up an MPAK without address list for each of the addressees in the address list, taking the type dependent component from the original packet and putting the addressees from the address list into the addressee field of the respective new packets. The new packets are then dispatched to the designated addressees.

The terminal's normal action when receiving the packet:

The terminal only receives this packet as a returned packet.

Length of the packet

The length can vary between 34 and 545 octets.

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Series Date 1990-02-19 1 Rev A T. F. MTS09A.2

TEXT with address list as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

--	--	--	--	--	--	--	--

octet 4-6:

--	--	--

 addressee: MOBITE network

--	--	--	--	--	--	--	--

octet 7:

0	0	0	0	0	1	0	X
---	---	---	---	---	---	---	---

octet 8:

0	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---

ADDRESS LIST:

octet 9:

--	--	--	--	--	--	--	--

 number of addressees

octet 10-12:

--	--	--

 addressee 1

--	--	--	--	--	--	--	--

octet 13-15:

--	--	--

 addressee 2

--	--	--	--	--	--	--	--

octet 16-18:

--	--	--

 addressee 3

--	--	--	--	--	--	--	--

octet 19-21:

--	--	--

 addressee 4

--	--	--	--	--	--	--	--

octet 22-24:

--	--	--

 addressee 5

--	--	--	--	--	--	--	--

octet 25-27:

--	--	--

 addressee 6

--	--	--	--	--	--	--	--

octet 28-30:

--	--	--

 addressee 7

--	--	--	--	--	--	--	--

TYPE DEPENDENT COMPONENT:

octet 31-33:

--	--	--

 time

--	--	--	--	--	--	--	--

octet 34 etc:

--	--	--	--	--	--	--	--

 text (max. 512 octets)

(X = optional 0 or 1)

text: 1-512 octets.
According to 'MOBITE text code'.
Please refer to R1-06

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3.3 DATA (data messages) without address list:

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or group.

Raised flags:

Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the data information.

The network's normal action when receiving a packet:

The network dispatches the packet to the designated addressee.

The terminal's normal action when receiving a packet:

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference R1-08.

Length of the packet:

The length can vary between 12 and 523 octets.

Buildings

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	<small>Desig. Date</small> 1990-02-19	<small>Ver. F.A.</small> A MTS09A.2

DATA without address list as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3:		sender	
octet 4-6:		addressee	

octet 7:	0 0 0 0	0 0 0 0	X
----------	---------	---------	---

octet 8:	0 0 0 0	0 0 0 1	0
----------	---------	---------	---

TYPE DEPENDENT COMPONENT:

octet 9-11:		time	
-------------	--	------	--

octet 12:etc		data (max. 512 octets)	
--------------	--	------------------------	--

(X = optional 0 or 1)

data: 1-512 complete octets.
Optional coding.

Buildout

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3.4 DATA (data messages) with address list:

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

The network is stated in the ordinary address field.

The intended message receivers are stated in the address list. The address list contains subscription numbers, each of which can designate a terminal subscription, a personal subscription or a group. Compare with the ordinary address field in 'DATA' without address list.

Raised flags:

Requirement: SENDLIST_F
Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the data information to a number of designated addressees.

The network's normal action when receiving the packet:

The network copies the common component and type dependent component and dispatches the new packets to the designated addressees.

The terminal's normal action when receiving the packet:

The terminal only receives this packet as a returned packet.

Length of the packet

The length can vary between 34 and 545 octets.

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MPAK COMMON COMPONENT:

sender

addressee: MOBILTEX network

0 0 0 | 0 | 0 1 0 x

0 0 | 0 | 0 0 0 1 0

number of addresses

number of addresses

addressee 1

addressee 2

addressee 3

addressee 4

addressee 5

addressee 6

addressee 7

octet 31-33:

time

data (max. 512 octets)

```
data:      1-512 complete octets.
           Optional coding.
```

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3.5 STATUS (status messages) without address list:

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or group.

Raised flags:

Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the status information.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee.

The terminal's normal action when receiving the packet:

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference R1-08.

Length of the packet

12 octets.

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STATUS without address list as generated by a terminal:

MPAK COMMON COMPONENT:

sender

addressee
$$\begin{array}{ccc|c|ccc} 0 & 0 & 0 & 0 & 0 & 0 & 0 & x \end{array}$$

0 0 | 0 | 0 0 0 1 1

TYPE DEPENDENT COMPONENT:

time

status code

(X = optional 0 or 1)

status code: 1 octet.
Optional coding. (0-255 decimal).

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3.6 STATUS (status message) with address list:

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

The network is stated in the ordinary address field.

The intended message receivers are stated in the address list. The address list contains subscription numbers, each of which can designate a terminal subscription, a personal subscription or a group. Compare with the ordinary address field in 'STATUS' without address list.

Raised flags:

Requirement: SENDLIST_F

Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the status information to a number of designated addressees.

The network's normal action when receiving the packet:

The network copies the common component and type dependent component and dispatches the new packets to the designated addresses.

The terminal's normal action when receiving the packet:

The terminal only receives this packet as a returned packet.

Length of the packets:

34 octets.

Block:

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Cantel Mobitex -

SI/1056 - A 296 5171/2 Ue
System Date 1990-02-19 12:00 A F. F. MTS09A.2

STATUS with address list as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

octet 4-6:

--	--	--

 addressee: MOBITEK network

octet 7:

0	0	0	0	0	1	0	X
---	---	---	---	---	---	---	---

octet 8:

0	0	0	0	0	0	1	1
---	---	---	---	---	---	---	---

ADDRESS LIST:

octet 9:

--	--	--	--	--	--	--	--	--	--	--	--

 number of addressees

octet 10-12:

--	--	--

 addressee 1

octet 13-15:

--	--	--

 addressee 2

octet 16-18:

--	--	--

 addressee 3

octet 19-21:

--	--	--

 addressee 4

octet 22-24:

--	--	--

 addressee 5

octet 25-27:

--	--	--

 addressee 6

octet 28-30:

--	--	--

 addressee 7

TYPE DEPENDENT COMPONENT:

octet 31-33:

--	--	--

 time

octet 34:

--	--	--

 status code

(X = optional 0 or 1)

status code: 1 octet.
Optional coding. (0-255 decimal).

Boilers

Reprova

Cantel Mobitex

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Creation Date	1990-02-19	Rev A
		File Name MTS09A.2

3.7 HPDATA (data message with higher protocol identification) without address list

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or group.

Raised flags:

Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the hpdata information..

The network's normal action when receiving the packet

The network dispatches the packet to the designated addressee.

The terminal's normal action when receiving the packet:

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference R1-08.

Length of the packet:

The length of the packet can vary between 13 to 524 octets.

Bidderet

Reproes

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SI 51/1056 - A 296 5171/2 Ue
 Date: 1990-02-19 (Rev) A
 File: MTS09A.2

HPDATA without address list as generated by a terminal :

MPAK COMMON COMPONENT:

octet 1-3:

sender							
--------	--	--	--	--	--	--	--

octet 4-6:

addressee							
-----------	--	--	--	--	--	--	--

octet 7:

0	0	0	0	0	0	0	X
---	---	---	---	---	---	---	---

octet 8:

0	0	0	0	0	1	0	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-11:

time							
------	--	--	--	--	--	--	--

octet 12:

protocol identification							
-------------------------	--	--	--	--	--	--	--

octet 13:etc

data (max 512 octets)							
-----------------------	--	--	--	--	--	--	--

(X = optional 0 or 1)

data 1-512 complete octets.
Optional coding.

BilHeart

Repro

A 296 5130/4

Cantel Mobitex

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3.8 HPDATA (data message with higher protocol identification) with address list

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

The network is stated in the ordinary address field.

The intended message receivers are stated in the address list. The address list contains subscription numbers, each of which can designate a terminal subscription, a personal subscription or a group. Compare with the ordinary address field in 'HPDATA' without address list.

Raised flags:

Requirement: SENDLIST_F
 Optional: MAILBOX_F

Criteria for generating the packet:

The user or the application has ordered sending of the hpdata information to a number of designated addressees.

The network's normal action when receiving the packet

The network copies the common component and type dependent component, and dispatches the new packets to the designated addressees.

The terminal's normal action when receiving the packet:

The terminal only receives this packet as a returned packet.

Length of the packet:

The length of the packet can vary between 35 to 546 octets.

Bidder:

Revised

Cantel Mobitex -

No. 51/1056 - A 296 5171/2 Ue
Series - Date 1990-02-19 Rev. A Pt. 2.1
MTS09A.2

HPDATA with address list as generated by a terminal :

MPAK COMMON COMPONENT:

octet 1-3:

sender

octet 4-6:

addressee: MOBITEK network

octet 7:

0	0	0	0	0	1	0	X
---	---	---	---	---	---	---	---

octet 8:

0	0	0	0	0	1	0	0
---	---	---	---	---	---	---	---

ADDRESS LIST:

octet 9:

number of addressees

octet 10-12:

addressee 1

octet 13-15:

addressee 2

octet 16-18:

addressee 3

octet 19-21:

addressee 4

octet 22-24:

addressee 5

octet 25-27:

addressee 6

octet 28-30:

addressee 7

TYPE DEPENDENT COMPONENT:

octet 31-33:

time

octet 34:

protocol identification

octet 35 etc:

data (max 512 octets)

(X = optional 0 or 1)

data 1-512 complete octets.Optional coding.

Block:

Repeat:

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3.9 EXTPAR (external packet):

Designated sender:

External network, terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription, group or external network.

Raised flags:

Requirement: EXTERN_F

Criteria for generating the packet:

The user or the application has ordered sending of information to or from external telecommunications network.

The network's normal action when receiving the packet:

If the network receives EXTPAR from a subscriber in MOBITEK, the packet is dispatched to the designated external telecommunications network which then sends it to the designated subscription in this network.

If the network receives EXTPAR from an external telecommunications network, the packet is dispatched to the designated subscription in MOBITEK.

The terminal's normal action when receiving the packet:

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference RI-08.

Length of the packet:

To be defined.

Block:

Page:

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CanTel Mobitex -

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EXTPAK as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3:	sender
octet 4-6:	addressee: external network MAN
octet 7:	0 0 0 0 0 0 0 0
octet 8:	0 0 1 0 0 0 0 1

TYPE DEPENDENT COMPONENT:

octet 9-11:	time
octet 12 etc:	to be defined
	to be defined

(X = optional 0 or 1)

The type dependent component has not yet been defined because the external gateways are not yet fully specified. The type dependent component will include a field "external data", transparent to data for the external network.

Bit/Byte:

Repro:

A 297.5133-3

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4 PSOSCOM

This chapter describes all "packet switched emergency communication" packets.

4.1 SOS (emergency signal):

Designated sender:

Terminal subscription or personal subscription

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The user or the application has ordered sending of the emergency signal.

The network's normal action when receiving the packet:

The network generates SOSINFO and sends this SOSINFO to the emergency receiver.

The terminal's normal action when receiving the packet:

The terminal does not normally receive SOS. However, in the case of autonomous operation the SOS can be returned to all terminals within a limited area. In this case the SOS packet is addressed to the All Terminals Group MAN.

The emergency information in the packet is stored, processed and presented to the user of the addressed subscription, according to reference R1-08.

Length of the packet:

The length can vary between 11 and 267 octets.

Breaker

Reprod

A 202 51553

51/1056 - A 296 5171/2 Ue		
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MPAK COMMON COMPONENT:

sender

addressee: MOBITEK network

0 0 0 | 0 | 0 0 0 0

0 1 | 0 | 0 0 0 0 1

octet 9-11:

time

dynamic emergency information

information: 0-256 complete octets. Selection of
'MOBITEX text code' according to reference
R1-06.

Cantel Mobitex

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 From Date 1990-02-19 1 Rev. A File No. MTS09A.2

4.2 SOSINFO (emergency message):

Designated sender:

Terminal subscription or personal subscription can be designated the sender.

The packet is always generated by the network however.

Designated addressee:

Terminal subscription or personal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network has received SOS from the sender. The network supplements this with static emergency information stored in the network and creates a SOSINFO packet. The network send the SOSINFO to the addressee.

The network's normal action when receiving the packet:

The network does not normally receive SOSINFO.

The terminal's normal action when receiving the packet:

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference R1-08.

Note that in the case of autonomous operation the SOSINFO can be returned to all terminals within a limited area. In this case the SOSINFO packet is addressed to the All Terminals group MAN.

Length of the packet:

The length can vary between 11 and 523 octets.

Bibliography

References

Cantel Mobitex

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SOSINFO as generated by network

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

--	--	--	--	--	--	--	--

octet 4-6:

--	--	--	--	--	--

 addressee

--	--	--	--	--	--	--	--

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

0	1	0	0	0	0	1	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-11:

--	--	--	--	--	--	--	--	--

 time

--	--	--	--	--	--	--	--	--

octet 12 etc

--	--	--	--	--	--	--	--	--

 static emergency information

--	--	--	--	--	--	--	--	--

octet etc.

--	--	--	--	--	--	--	--	--

 dynamic emergency information

--	--	--	--	--	--	--	--	--

static emergency information:

0-256 complete octets.
Selection of 'MOBITEX text code' according to
reference R1-06.

dynamic emergency information:

0-256 complete octets.
Selection of 'MOBITEX text code' according to
reference R1-06.

Signiert

Repro

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4.3 SOSACK (emergency acknowledgement):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription or personal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal has received a SOSINFO. Only a manual acknowledgement of SOSINFO will initiate SOSACK. (See reference R1-08).

The network's normal action when receiving the packet

The network dispatches the packet to the designated addressee. Note that the network does not monitor that SOSINFO is followed by SOSACK. The use of SOSACK is optional to the application.

The terminal's normal action when receiving the packet:

The information in the packet is stored, processed and/or presented to the user of the addressed subscription, according to reference R1-08.

The length of the packet:

12 octets.

Start

Repeat

Cantel Mobitex

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1990-02-19 A MTS09A.2

SOSACK as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3: sender

octet 4-6: addressee

octet 7: 0 0 0 0 0 0 0 0

octet 8: 0 1 0 0 0 0 1 1

TYPE DEPENDENT COMPONENT:

octet 9-11: time

octet 12: emergency acknowledgement status

emergency acknowledgement status:

1 octet.

Optional coding (0-255 decimal) according to application.

Receives

Reproducible

A 1056 515302

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5 CSUBCOM

This chapter describes all "circuit switched subscriber and emergency communication" packets.

5.1 CONREQ (connection request):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or group.

Raised flags:

Optional: DIGITAL_F

Criteria for generating the packet:

The user or the application has requested circuit switched connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection is established.

If the connection is approved and the terminal is prot 1 or prot_2B, the connection is established without sending CONGRA.

If the connection is approved and the terminal is prot 2A, a positive acknowledgement is sent in the form of CONGRA.

The terminal's normal action when receiving the packet

The terminal normally receives CONREQ when another subscription has requested a connection with one of the terminal's subscriptions.

Prot_1 and prot_2A terminals will then generate CONREA for connection to take place.

Prot_2B terminal will then generate LINSEL and CONREA for connection to take place.

The terminal can also receive a returned CONREQ when the request has been refused for any reason. The terminal then considers the connection as disconnected.

Length of the packet:

10 octets.

Buildings

Repairs

Cantel Mobitex

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CONREQ as generated by a terminal

MPAK COMMON COMPONENT

octet 1-3:

--	--	--	--	--	--	--	--	--	--	--	--

 sender

octet 4-6:

--	--	--	--	--	--	--	--	--	--	--	--

 addressee

octet 7:

0	0	0	0	0	0	X	0
---	---	---	---	---	---	---	---

octet 8:

1	0	0	0	0	0	0	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9:

--	--	--	--	--	--	--	--	--	--	--	--

 line number

octet 10:

--	--	--	--	--	--	--	--	--	--	--	--

 connection identity

(X = optional 0 or 1)

Line_number when generating from a terminal

prot_1 and prot_2A: line number = 0

prot_2B line number = actual line

The connection identity is selected cyclically by the terminal.

Blanket

Repro

A-102 51539

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5.2 CONFAST (connection request fast):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or group.

Raised flags:

Optional: DIGITAL_F

Criteria for generating the packet:

The user or the application has requested fast circuit switched connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection is established.

If the connection is approved and the terminal is prot 1 or prot_2B, the connection is established without sending CONGRA.

If the connection is approved and the terminal is prot 2A, a positive acknowledgement is sent in the form of CONGRA.

The terminal's normal action when receiving the packet

The terminal normally receives CONFAST when another subscription has requested a fast connection with one of the terminal's subscriptions.

For prot 1 and prot_2A terminals the connection takes place immediately.

prot 2B terminal will then generate LINSEL for connection to take place.

The terminal can also receive a returned CONFAST when the request has been refused for any reason. The terminal then considers the connection as disconnected.

Length of the packet:

10 octets.

5.2B:rev

Revised

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CONFAST as generated by a terminal

MPAK COMMON COMPONENT

octet 1-3:

--	--	--

 sender

--	--	--

octet 4-6:

--	--	--

 addressee

--	--	--

octet 7:

0	0	0	0	0	0	X	0
---	---	---	---	---	---	---	---

octet 8:

1	0	0	0	1	0	1	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9:

--	--	--	--	--	--	--	--

 line number

octet 10:

--	--	--	--	--	--	--	--

 connection identity

(X = optional 0 or 1)

Line_number when generating from a terminal

prot_1 and prot_2A: line number = 0

prot_2B line number = actual line

The connection identity is selected cyclically by the terminal.

Budget

Repro

A 392 51530

Cantel Mobitex

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5.3 SOSCONREQ (emergency connection request):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription or personal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The user or the application has requested emergency connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection is established.

If the emergency connection is approved and the terminal is prot 1 or prot 2B, the connection is established without sending CONGRA.

If the emergency connection is approved and the terminal is prot 2A, a positive acknowledgement is sent in the form of CONGRA.

The terminal's normal action when receiving the packet

The terminal normally receives SOSCONREQ when another subscription has requested a emergency connection with one of the terminal's subscriptions.

Prot 1 and prot 2A terminals will then generate CONREA for connection to take place.

Prot 2B terminal will then generate LINSEL and CONREA for connection to take place.

The terminal can also receive a returned SOSCONREQ when the request has been refused for any reason. The terminal then considers the connection as disconnected.

Length of the packet:

10 octets.

Block

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MPAK COMMON COMPONENT:

sender

addressee

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

1 0 | 0 | 1 0 0 0 1

octet 9:

line number

connection identity

Line number when generating from a terminal

prot_1 and prot_2A: line number = 0

```
prot_2B      line number = actual line
```

The connection identity is selected cyclically by the terminal.

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5.4 SOSCONFAST (emergency connection request fast):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription or personal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The user or the application has requested fast emergency connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection is established.

If the emergency connection is approved and the terminal is prot_1 or prot_2B, the connection is established without sending CONGRA.

If the emergency connection is approved and the terminal is prot_2A, a positive acknowledgement is sent in the form of CONGRA.

The terminal's normal action when receiving the packet

The terminal normally receives SOSCONFAST when another subscription has requested a fast emergency connection with one of the terminal's subscriptions.

For prot_1 and prot_2A terminals the connection takes place immediately.

Prot_2B terminal will then generate LINSEL for connection to take place.

The terminal can also receive a returned SOSCONFAST when the request has been refused for any reason. The terminal then considers the connection as disconnected.

Length of the packet:

10 octets.

Subdoc:

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SOSCONFAST as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

octet 4-6:

--	--	--

 addressee

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	0	0	1	1	0	1	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9:

--	--	--	--	--	--	--	--

 line number

octet 10:

--	--	--	--	--	--	--	--

 connection identity

(X = optional 0 or 1)

Line_number when generating from a terminal

prot_1 and prot_2A: line number = 0

prot_2B line number = actual line

The connection identity is selected cyclically by the terminal.

Bidder:

Repro:

A:02 01543

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5.5 ADDCONREQ (additional connection request):

ADDCONREQ can be used to direct the connection to an extension connected to the receiving terminal, e.g. a PABX extension. In addition to the fields contained in CONREQ, ADDCONREQ has an additional field of 20 octets available to the application layers. This field can be used to direct the receiving terminal to take the proper action.

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription or personal subscription.

Raised flags:

Optional: DIGITAL_F

Criteria for generating the packet:

The user or the application has requested additional connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection is established.

If the connection is approved and the terminal is prot 1 or prot_2B, the connection is established without sending CONGRA.

If the connection is approved and the terminal is prot 2A, a positive acknowledgement is sent in the form of CONGRA.

Bidder:

Expire:

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The terminal's normal action when receiving the packet

The terminal normally receives ADDCONREQ when another subscription has requested additional connection with one of the terminal's subscriptions.

Prot_1 and prot_2A terminals will then generate CONREA for connection to take place.

Prot_2B terminal will then generate LINSEL and CONREA for connection to take place.

The terminal can also receive a returned ADDCONREQ when the request has been refused for any reason. The terminal then considers the connection as disconnected.

The field for additional information can be used without any limitations by the user.

Length of the packet:
30 octets.

Buskers

Report

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MPAK COMMON COMPONENT:

sender

addressee

0 0 0 | 0 | 0 0 x 0

$$\begin{array}{ccccccc} 1 & 0 & | & 0 & | & 0 & 0 & 0 & 1 & 0 \end{array}$$

octet 9:

line number

connection identity

additional information

```
additional
information: 20 octets.
              Optional coding.
```

prot_1 and prot_2A: line number = 0

prot 2B line number = actual line

The connection identity is selected cyclically by the terminal.

Bidsort:

Ref: 04

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5.6 ADDCONFAST (additional connection request fast):

ADDCONFAST can be used to direct the connection to an extension connected to the receiving terminal, e.g. a FAX extension. In addition to the fields contained in CONFAST, ADDCONFAST has an additional field of 20 octets available to the application layers. This field can be used to direct the receiving terminal to take the proper action.

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription or personal subscription.

Raised flags:

Optional: DIGITAL_F

Criteria for generating the packet:

The user or the application has requested fast additional connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection is established.

If the connection is approved and the terminal is prot_1 or prot_2B, the connection is established without sending CONGRA.

If the connection is approved and the terminal is prot_2A, a positive acknowledgement is sent in the form of CONGRA.

Signature

Exproce

A 29751330

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1990-02-19	A	MTS09A.2				

The terminal's normal action when receiving the packet

The terminal normally receives ADDCONFASST when another subscription has requested a fast additional connection with one of the terminal's subscriptions.

For prot_1 and prot_2A terminals the connection takes place immediately.

Prot_2B terminal will then generate LINSEL for connection to take place.

The terminal can also receive a returned ADDCONFASST when the request has been refused for any reason. The terminal then considers the connection as disconnected.

The field for additional information can be used free by the subscriber.

Length of the packet:

30 octets.

Buildert

Repro

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ADDCONFAS as generated by a terminal

MPAK COMMON COMPONENT:

octet 1-3:

sender		
--------	--	--

octet 4-6:

addressee		
-----------	--	--

octet 7:

0	0	0	0	0	0	X	0
---	---	---	---	---	---	---	---

octet 8:

1	0	0	0	1	1	0	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9:

line number							
-------------	--	--	--	--	--	--	--

octet 10:

connection identity							
---------------------	--	--	--	--	--	--	--

octet 11-30:

additional information																			
------------------------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

(X = optional 0 or 1)

additional
information: 20 octets.
Optional coding.

Line_number when generating from a terminal

prot_1 and prot_2A: line number = 0
prot_2B line number = actual line

The connection identity is selected cyclically by the terminal.

Bulkset

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A 296 5153-4

Cantel Mobitex

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5.7 CONGRA (line connection request approved):

Designated sender:

Terminal subscription, personal subscription, group or external network.

The packet is always generated by the network.

Designated addressee:

Fixed terminal subscription prot_2A or personal subscription logged-in to a fixed terminal prot_2A.

Raised flags: -

No raised flags.

Criteria for generating the packet:

The network has received CONREQ, SOSCONREQ, EXTCONREQ, ADDCONREQ, CONFAST, SOSCONFAST or ADDCONFAST from a fixed terminal prot_2A and approved circuit switched connection from the terminal.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal connects the circuit switched connection to the designated line.

Length of the packet:

10 octets.

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CONGRA as generated by the network:

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--	--	--	--	--	--	--	--	--	--

 sender

octet 4-6:

--	--	--	--	--	--	--	--	--	--	--	--

 addressee

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	0	0	0	0	0	1	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9:

--	--	--	--	--	--	--	--	--	--	--	--

 line number

octet 10:

--	--	--	--	--	--	--	--	--	--	--	--

 connection identity

Note: The line number is stated by the network. The connection identity is the same as the connection identity for CONREQ, SOSCONREQ, EXTCONREQ, ADDCONREQ, CONFAST, SOSCONFAST or ADDCONFAST.

Backout

Reprint

A 296 51555

Cantel Mobitex

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5.8 LINSEL (line selected):

Designated sender:

Fixed terminal subscription prot_2B or personal subscription logged-in to a fixed terminal prot_2B.

Designated addressee:

Terminal subscription, personal subscription or external network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The fixed terminal prot_2B or personal subscription logged-in to a fixed terminal prot_2B has received CONREQ, SOSCONREQ, EXTCONREQ, ADDCONREQ, CONFAST, SOSCONFAST or ADDCONFAST.

Note: If the connection sequence is started with CONREQ, ADDCONREQ, SOSCONREQ or EXTCONREQ both LINSEL and CONREA must be sent by prot_2B terminal.

The network's normal action when receiving the packet:

If the connection sequence is started with CONFAST, ADDCONFAST or SOSCONFAST the network connects the circuit switched connection to the designated line.

If the connection sequence is started with CONREQ, ADDCONREQ, EXTCONREQ or SOSCONFAST the network expects the terminal to send CONREA after LINSEL.

The terminal's normal action when receiving the packet:

Terminal does not normally receive the packet.

Length of the packet:

10 octets.

Blanket

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MPAK COMMON COMPONENT:

sender

addressee

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

1	0	0	0	1	1	0	1
---	---	---	---	---	---	---	---

line number

connection identity

The connection identity is the same as the connection identity for CONREQ, SOSCONREQ, EXTCONREQ, ADDCONREQ, CONFAST, SOSCONFAST or ADDCONFAST.

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5.9 CONORD (line connection order during group call):

Designated sender:

Terminal subscription or personal subscription.
 The packet is always generated by the network.

Designated addressee:

Group.

Raised flags:

No raised flags.

Criteria for generating the packet:

Another subscription has requested real time connection with the addressee which comprises a group.

The network's normal action when receiving the packet

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal connects the designated line (without acknowledgement with a data packet), i.e. CONREA and DISCON packets should not be sent by terminals which receive CONORD.

Note only mobile terminals receive CONORD.

Length of the packet

10 octets.

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No. 206		
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MPAK COMMON COMPONENT:

sender

addressee

0 0 0 | 0 | 0 0 0 0

1 0 | 0 | 0 0 1 0 0

line number

connection identity

Note: A group call can only be disconnected by the A party. This means, when a B party want to leave or disconnect a group call, the line should be considered as disconnected without sending DISCON.

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5.10 CONREA (ready for line connection):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

Terminal subscription, personal subscription or external network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal has received CONREQ, ADDCONREQ, SOSCONREQ or EXTCONREQ from another subscription and is ready to connect the circuit switched connection (HOOK-OFF signal has been received from application layer). CONREA should not be sent when the terminal receives CONORD, CONFAST, ADDCONFAST or SOSCONFAST.

The network's normal action when receiving the packet

The connection is considered established until DISCON is generated by one of the parties or the network.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet

10 octets.

Bridges:

Repro:

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MPAK COMMON COMPONENT:

sender

addressee

0 0 0 | 0 | 0 0 0 0

1 0 0 0 0 1 0 1

line number

connection identity

Note: For prot_1 and prot_2A terminals the line number is the number that was entered in CONREQ (ADDCONREQ, SOSCONREQ or EXTCONREQ) by the network. For prot_2B terminals the line number is the number that was entered in LINSER by the terminal. The connection identity is same as the CONREQ (ADDCONREQ, SOSCONREQ or EXTCONREQ) referred to.

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5.11 DISCON (disconnection):

Designated sender:

Terminal subscription, personal subscription, the network or external network.

Designated addressee:

Terminal subscription, personal subscription, group or external network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The sender, the application or the network wishes to break the real time connection. DISCON is used irrespective of the type of connection.

Note: A connection established with CONORD, i.e. a group call, should not be disconnected by the B-party terminal. The terminal consider thus the line disconnected without sending DISCON.

The network's normal action when receiving the packet:

Prepares the disconnection.

The terminal's normal action when receiving the packet:

Breaks the connection.
If the designated connection is already broken, no action is taken.

Length of the packet:

10 octets.

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MPAK COMMON COMPONENT:

sender

addressee

0 0 0 | 0 | 0 0 0 0

1 0 | 0 | 0 0 1 1 0

line number

connection identity

connection identity

```
prot_1 terminal      line number = 0
prot_2A or prot_2B  line number = actual line
```

Also the connection identity is to be same as the connection identity for CONREQ (ADDCONREQ, SOSCONREQ, EXTCONREQ, CONFAST, ADDCONFAST or SOSCONFAST).

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5.12 EXTCONREQ (external connection request):

Designated sender:

Terminal subscription, personal subscription or external network.

Designated addressee:

External network, terminal subscription, personal subscription.

Raised flags:

Optional: DIGITAL_F

Criteria for generating the packet:

The user or the application has requested external connection.

The network's normal action when receiving the packet:

The network dispatches the packet to the designated addressee and a real time connection with the external network is established.

If the connection is approved and the terminal is prot_1 or prot_2B, the connection is established without sending CONGRA.

If the connection is approved and the terminal is prot_2A, a positive acknowledgement is sent in the form of CONGRA.

Blanket

Regres

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Cantel Mobitex-

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The terminal's normal action when receiving the packet:

The terminal normally receives EXTCONREQ when another subscription has requested an external connection with one of the terminal's subscriptions. If the A party's subscription number in the external network is known, this is stated in the designated field in the type-dependent component.

Prot_1 and prot_2A terminals will then generate CONREA for connection to take place.

Prot_2B terminal will then generate LINSEL and CONREA for connection to take place.

The terminal can also receive a returned EXTCONREQ when the request has been refused for any reason. The terminal then considers the connection as disconnected.

Length of the packet:

30 octets.

Blanket

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MPAK COMMON COMPONENT:

sender

addressee

0	0	0	0	0	0	X	0
---	---	---	---	---	---	---	---

1	0	1	0	0	0	1	0
---	---	---	---	---	---	---	---

octet 9:

line number	code
1	1000
2	1001
3	1002
4	1003
5	1004
6	1005
7	1006
8	1007
9	1008
10	1009
11	1010
12	1011
13	1012
14	1013
15	1014
16	1015
17	1016
18	1017
19	1018
20	1019
21	1020
22	1021
23	1022
24	1023
25	1024
26	1025
27	1026
28	1027
29	1028
30	1029
31	1030
32	1031
33	1032
34	1033
35	1034
36	1035
37	1036
38	1037
39	1038
40	1039
41	1040
42	1041
43	1042
44	1043
45	1044
46	1045
47	1046
48	1047
49	1048
50	1049
51	1050
52	1051
53	1052
54	1053
55	1054
56	1055
57	1056
58	1057
59	1058
60	1059
61	1060
62	1061
63	1062
64	1063
65	1064
66	1065
67	1066
68	1067
69	1068
70	1069
71	1070
72	1071
73	1072
74	1073
75	1074
76	1075
77	1076
78	1077
79	1078
80	1079
81	1080
82	1081
83	1082
84	1083
85	1084
86	1085
87	1086
88	1087
89	1088
90	1089
91	1090
92	1091
93	1092
94	1093
95	1094
96	1095
97	1096
98	1097
99	1098
100	1099

connection identity .

subscr. no. in external network

Line number when generating from a terminal

prot 1 and prot 2A: line number = 0

prot_2B line number = actual line

The connection identity is selected cyclically by the terminal.

In cases where the packet is generated from the terminal, the addressee should be the external network's MAN. If the packet is received by a terminal, the sender is the external network's MAN.

subscr. no. in external network:

The subscription number in the external network of the intended addressee (i.e. the B-party). The field size is 20 octets and the number is given right justified (leading spaces) according to 'MOBITEX text code'.

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Example:

The telephone number 031-90 300 is coded as 03190300 and will be the following in 'MOBITEX text code':

	8	7	6	5	4	3	2	1	
octet 1:	0	0	1	0	0	0	0	0	(space)
octet 2:	0	0	1	0	0	0	0	0	(space)
:	:	:	:	:	:	:	:	:	:
octet 11:	0	0	1	0	0	0	0	0	(space)
octet 12:	0	0	1	0	0	0	0	0	(space)
octet 13:	0	0	1	1	0	0	0	0	(0)
octet 14:	0	0	1	1	0	0	1	1	(3)
octet 15:	0	0	1	1	0	0	0	1	(1)
octet 16:	0	0	1	1	1	0	0	1	(9)
octet 17:	0	0	1	1	0	0	0	0	(0)
octet 18:	0	0	1	1	0	0	1	1	(3)
octet 19:	0	0	1	1	0	0	0	0	(0)
octet 20:	0	0	1	1	0	0	0	0	(0)

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Cantel Mobitex -

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5.13 CLOOPON (loop test start):

Designated sender:

The network.

Designated addressee:

Fixed terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network wishes to loop test the designated line for real time connection.

The network's normal action when receiving the packet

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The Tx and Rx wires, of the designated line, should be loop tested to be measured by the network. All other activity on the line is discontinued.

Length of the packet:

9 octets.

Subcar:

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CLOOPON as generated by the network:

MPAK COMMON COMPONENT:

octet 1-3: sender: the MOBITEK network

octet 4-6: addressee

octet 7: 0 0 0 0 0 0 0 0

octet 8: 1 0 0 0 0 1 1 1

TYPE DEPENDENT COMPONENT:

octet 9: line number

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A. 297 5155-3

Cantel Mobitex

No	51/1056 - A 296 5171/2 Ue
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Rev	A
File	MTS09A.2

5.14 CLOOPOFF (loop test end):

Designated sender:

The network.

Designated addressee:

Fixed terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The loop test on the line ends.

The network's normal action when receiving the packet

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal should break the designated loop test. The line activity is continued.

The length of the packet:

9 octets.

Shidars

Reyno

Cantel Mobitex -

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CLOOPOFF as generated by the network:

MPAK COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network

octet 4-6:

addressee

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 0 0 0 1 0 0 0

TYPE DEPENDENT COMPONENT:

octet 9:

line number

Bidkarr

Reprod

A 207 5153-3

Cantel Mobitex

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Doc For	MTS09A.2	

5.15 LINEON (opening of line connection):

Designated sender:

Fixed terminal subscription prot_2A

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

A fixed terminal wishes to open one of its lines intended for real time connection.

The network's normal action when receiving the packet

The network opens the indicated line.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

9 octets.

Subcode:

Repeat:

A 29251530

Cantel Mobitex -

51/1056 - A 296 5171/2 Ue
1990-02-19 A MTS09A.2

LINEON as generated by a terminal:

MPAK COMMON COMPONENT:

octet 1-3: sender: fixed terminal

octet 4-6: addressee: the MOBITEX network

octet 7: 0 0 0 0 0 0 0 0

octet 8: 1 0 0 0 1 0 0 1

TYPE DEPENDENT COMPONENT:

octet 9: line number

Signature

Repro

A 297 5153-1

Cantel Mobitex -

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5.16 LINEOFF (barring of line connection):

Designated sender:

Fixed terminal subscription prot_2A

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

A fixed terminal wishes to bar one of its line intended for real time connection.

The network's normal action when receiving the packet

The network disables the indicated line.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

9 octets.

Bidirect

Repro

A 202 5155.3

Cantel Mobitex

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1990-02-19	A	MTS09A.2				

LINEOFF as generated by a terminal:

MPAK COMMON COMPONENT:

octet 1-3:

sender: fixed terminal

octet 4-6:

addressee: the MOBITEK network

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	0	0	0	1	0	1	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9:

line number

Builders

Reprod

A 1992 415533

Cantel Mobitex-

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6 DTESERV

This chapter describes all Data Terminal Service communication packets.

6.1 LOGINREQ (login request):

Designated sender:

Terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

A user or the application wishes to log-in a personal subscription to the terminal.

Note: LOGINREQ should only be sent if there is enough space for another subscriber in the FLEXLIST and/or the subscription is not already present.

The network's normal action when receiving the packet:

The network checks that the log-in can take place.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet. However, if this would occur, it should be shown to the user that the log-in request has failed.

Length of the packet:

19 octets.

Signature

Report

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MTS09A.2

LOGINREQ as generated by a terminal:

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

octet 4-6:

--	--	--

 addressee: the MOBITEK network

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	1	0	0	0	0	0	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-11:

--	--	--

 personal subscription MAN

octet 12-19:

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

 password

password: 8 octets.
Selection of 'MOBITEK text code' according to reference R1-06. Passwords shorter than 8 characters are filled with leading spaces.

Example: The password FANTOM:

8	7	6	5	4	3	2	1
---	---	---	---	---	---	---	---

octet 1:

0	0	1	0	0	0	0	0
---	---	---	---	---	---	---	---

 (space)

octet 2:

0	0	1	0	0	0	0	0
---	---	---	---	---	---	---	---

 (space)

octet 3:

0	1	0	0	0	1	1	0
---	---	---	---	---	---	---	---

 (F)

octet 4:

0	1	0	0	0	0	0	1
---	---	---	---	---	---	---	---

 (A)

octet 5:

0	1	0	0	1	1	1	0
---	---	---	---	---	---	---	---

 (N)

octet 6:

0	1	0	1	0	1	0	0
---	---	---	---	---	---	---	---

 (T)

octet 7:

0	1	0	0	1	1	1	1
---	---	---	---	---	---	---	---

 (O)

octet 8:

0	1	0	0	1	1	0	1
---	---	---	---	---	---	---	---

 (M)

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6.2 LOGINGRA (login request granted):Designated sender:

Network.

Designated addressee:

Terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network approves the previously requested log-in (LOGINREQ).

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal stores the personal subscription MAN as one of the subscription numbers the terminal may/can receive packets to. When LOGINGRA is received, this should be sent to the application layer to be shown to the user.

Note: If the personal subscription is already logged-in, no further actions are taken.

Length of the packet:

11 octets.

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A 296 51534

Cantel Mobitex

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 Datum 1990-02-19 1 Rev. A 2. MTS09A.2

LOGINGRA as generated by the network:

MPAK COMMON COMPONENT:

octet 1-3: sender: the MOBITEK network

octet 4-6: addressee

octet 7: 0 0 0 0 0 0 0 0

octet 8: 1 1 0 0 0 0 1 0

TYPE DEPENDENT COMPONENT:

octet 9-11: Personal subscription MAN

Original

Reprod.

A 292 51502

Cantel Mobitex

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6.3 LOGINREF (login request refused):

Designated sender:

Network.

Designated addressee:

Terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network does not permit the requested log-in.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal notifies the user or the application that the log-in request has been refused by the network.

Length of the packet:

11 octets.

Support

Reprod

A 296 51503

Cantel Mobitex

SI No 51/1056 - A 296 5171/2 Ue
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LOGINREF as generated by the network:

MPAK COMMON COMPONENT:

octet 1-3: sender: the MOBITEX network

octet 4-6: addressee

octet 7: 0 0 0 0 0 0 0 0

octet 8: 1 1 0 0 0 0 1 1

TYPE DEPENDENT COMPONENT:

octet 9-11: Personal subscription MAN

Shikart:

Repro:

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6.4 LOGOUT (logout):

Designated sender:

Personal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

A personal subscription wished to log-out from the terminal. The terminal should only send the packet if the subscription is in the FLEXLIST containing the personal subscriptions. After generating the packet, the personal subscription is deleted from the FLEXLIST.

The network's normal action when receiving the packet:

The network deletes the log-in. The subscription is 'at rest' until further notice.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

11 octets.

BulkData

Regnoo

Cantel Mobitex

51/1056 - A 296 5171/2 Ue

1990-02-19 A MTS09A.2

LOGOUT as generated by a terminal:

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

octet 4-6:

--	--	--

 addressee: the MOBITEX network

octet 7:

0	0	0	0	0	0	0
---	---	---	---	---	---	---

octet 8:

1	1	0	0	0	1	0
---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-11:

--	--	--

 MAN (terminal subscription)

Boikart

Segrod

A 292 51533

Cantel Mobitex

No. 51/1056	- A 296 5171/2 Ue
Issue Date 1990-02-19	Rev. A F. L. MTS09A.2

6.5 LOGOUTORD (logout order):

Designated sender:

The network

Designated addressee:

Terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The personal subscription can only be logged-in to one terminal at a time. When a new log-in takes place and an old log-in is active (no LOGOUT has been sent), the network sends the LOGOUTORD packet to the old terminal in order to log-out the personal subscription from that terminal.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal deletes the personal subscription from the list of logged-in subscriptions. It should also be shown to the user that the personal subscription has been logged-out.

Length of the packet:

11 octets.

Revised

Revised

Cantel Mobitex

Sr No	51/1056 - A 296 5171/2 Ue		
Search Date	1990-02-19	Rev	A
		FL F.A	MTS09A.2

LOGOUTORD as generated by the network:

MPAK COMMON COMPONENT:

octet 1-3:	sender: the MOBITEX network
octet 4-6:	addressee
octet 7:	0 0 0 0 0 0 0 0
octet 8:	1 1 0 0 0 1 0 1

TYPE DEPENDENT COMPONENT:

octet 9-11:	Personal subscription MAN
-------------	---------------------------

Bridgman

Rayson

A 29251533

Cantel Mobitex

No. 51/1056 - A 296 5171/2 Ue

Date: 1990-02-19 Rev. A File: MTS09A.2

6.5 BORN (terminal active for first time):

Designated sender:

Terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal is active in MOBITEK for the first time or the terminal has lost important parts of its stored information, please see Main document, chapter "Parameters to be stored at power of".

If important parts, as stated above, is lost, BORN is replacing ROAM until a GROUPLIST is received. In this case the terminal should clear the list of personal subscriptions and the personal subscription must log-in again.

The network's normal action when receiving the packet:

The network sends the necessary information to the terminal (GROUPLIST).

The network also checks the terminal's Electronic Serial Number (ESN).

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

12 octets.

Author:

Repro:

Cantel Mobitex

Ver. No.	51/1056 - A 296	5171/2 De
Doc. No.	1990-02-19	A MTS09A.2

BORN as generated by the terminal:

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

octet 4-6:

--	--	--

 addressee: the MOBITEK network

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	1	0	0	0	1	1	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9 -12:

--	--	--	--

 ESN

ESN 4 octets.

This field states the electronic serial number.

Fixed terminals without the ESN function should fill in the ESN field with zero's (0's).

For the ESN specification, please refer to R1-06.

Buildings

Repro

A 100 51502

Cantel Mobitex

Doc No	51/1056 - A 296 5171/2 Ue
Current Date	1990-02-19
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File No	MTS09A.2

6.7 ACTIVE (terminal active):

Designated sender:

Terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

Mobile terminal :

There are four different criteria for the network layer in the mobile terminal to send an ACTIVE packet :

- 1) At power-on or returning from manual radio mode.
- 2) The message buffer has space for at least 6 messages of maximum length.
- 3) Re-establishing contact with the network.
- 4) On order from the application layer

The transmission of the ACTIVE packet may be delayed a certain period of time (see reference R1-06).

Fixed terminal :

The fixed terminal sends the ACTIVE packet immediately after power-on or when the data link layer has restarted.

The network's normal action when receiving the packet:

The network updates the information about the terminal subscription. Messages stored in the mailbox, which are intended to the terminal and the subscriber, are sent to the subscribers.

The network checks the ESN.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

12 octets.

Shinken

Reprod

A 297 51553

51/1056 - A 296 5171/2 Ue		
DATE	REV	FILE
1990-02-19	A	MTS09A.

MPAK COMMON COMPONENT:

sender

addressee: the MOBILTEX network

0 0 0 | 0 | 0 0 0 0

1 1 | 0 | 0 0 1 1 1

octet 9 -12:

ESN

This field states the electronic serial number.

For the ESN specification, please refer to R1-06.

Cantel Mobitex-

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6.8 INACTIVE (terminal no longer active):

Designated sender:

Terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The user or the application wishes to inactivate the terminal. INACTIVE is sent before the terminal is switched off and before the mobile terminal enters manual radio mode.

INACTIVE is also sent when the message buffer becomes full.

The network's normal action when receiving the packet:

The network registers the terminal as inactive, and will not send any message to the terminal until it is activated again.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

8 octets.

Budgets

Reprod

A 292 51533

Cantel Mobitex

No. 51/1056 - A 296 5171/2 Ue
 Date 1990-02-19 Rev A File MTS09A.2

INACTIVE as generated by the terminal:

MPAK COMMON COMPONENT:

octet 1-3:

--	--	--

 sender

octet 4-6:

--	--	--

 addressee: the MOBITEK network

octet 7:

0	0	0	0	0	0	0
---	---	---	---	---	---	---

octet 8:

1	1	0	0	1	0	0
---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT does not exist.

Buildart

Repro

A 296 51334

Cantel Mobitex

No. 51/1056 - A 296 5171/2 Ue
 Section Date Rev. Rev. Date
 1990-02-19 A MTS09A.2

6.9 DIE (the terminal may not send packets):

Designated sender:

The network..

Designated addressee:

Terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network generates this packet in order to prevent a terminal from send any user traffic to the network.

The network's normal action when receiving a packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

After the reception of DIE, the terminal must not send any user traffic (PSUBCOM, CSUBCOM, PSOSCOM). Only DTESERV packets are permitted until a LIVE packet has been received. It should also be shown to the user, that the terminal has received a DIE, and cannot send any user traffic.

Exceptions :

- 1) A CSUBCOM 'speech request' received by the terminal should result in a DISCON sent to the network.
- 2) The terminal may return packets to the network with the UNKNOWN_F raised.

Length of the packet:

8 octets.

Buskort

Reprod

Cantel Mobitex

51/1056 - A 296 5171/2 Ue
 1990-02-19 A MTS09A.2

DIE as generated by the network

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network

octet 4-6:

addressee

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 0 1 0 0 1

TYPE DEPENDENT COMPONENT does not exist.

Bidkare

Reprod

A 292 51393

Cantel Mobitex

St. No.	51/1056 - A 296	5171/2 Ue
Creation Date	1990-02-19	Rev A
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6.10 LIVE (the terminal may send packets again):

Designated sender:

The network.

Designated addressee:

Terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal has previously received 'DIE' but is now permitted to send user traffic again.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal may resume sending user traffic again. It should also be shown to the user, that the terminal has received a LIVE, and can resume sending user traffic.

Length of the packet:

8 octets.

Builds

Reprod

A 296 51532

Cantel Mobitex

Doc. No. 51/1056 - A 296 5171/2 Ue
 Service Date 1990-02-19 Rev. A P. 2.2 MTS09A.2

LIVE as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network

octet 4-5:

addressee

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 0 1 0 1 0

TYPE DEPENDENT COMPONENT does not exist.

Buildert

Reprod

A 091.5155-3

Cantel Mobitex-

No. 51/1056	- A 296	5171/2 Ue
Custom Date 1990-02-19	Rev A	File # MTS09A.2

6.11 ROAMORD (roaming order):

Designated sender:

The network.

Designated addressee:

The mobile terminal subscription or group.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network orders the terminal to send 'ROAM'.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

Sends 'ROAM'.

Length of the packet:

8 octets.

Buildnet

Repro

A-29251530

Cantel Mobitex

No. 51/1056 - A 296 5171/2 Ue
Version Date 1990-02-19 Rev A File Name MTS09A.2

ROAMORD as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network

octet 4-6:

addressee

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 0 1 0 1 1

TYPE DEPENDENT COMPONENT does not exist.

Budkov

Expend

A 292 51053

Cantel Mobitex-

No. 26	51/1056 - A 296 5171/2 Ue	
Document Date	1 Rev	Pr. For
1990-02-19	A	MTS09A.2

6.12 ROAM (roaming message):

Designated sender:

The mobile terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal has decided to send 'ROAM' according to the roaming algorithm procedure in the mobile terminal link layer or the terminal has received ROAMORD from the network.

The network's normal action when receiving the packet:

The network registers 'roaming' for the terminal.
The network also checks the ESN.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

12 octets.

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Reproce

51/1056 - A 296 5171/2 Ue		
DATE Recd	Rev	File No
1990-02-19	A	MTS09A.2

MPAK-COMMON COMPONENT:

sender

addressee: the MOBITEK network

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

1 1 | 0 | 0 1 1 0 0

octet 9 -12: ESN

This field states the electronic serial number.

For the ESN specification, please refer to R1-06.

Cantel Mobitex

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6.13 VICESOSRX (re-direction of emergency messages):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The subscriber which is stated the emergency receiver wishes that emergency messages (SOSINFO) should be re-directed to the predestinated alternative emergency receiver.

The network's normal action when receiving the packet:

The network registers that emergency messages should be sent to the alternative emergency receiver.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet. If the operation did not succeed, this should be shown to the user.

Length of the packet:

8 octets.

Budget

Repro

Cantel Mobitex-

No. 36
51/1056 - A 296 5171/2 Ue
Comm Date 1990-02-19 Rev A P. 1.1
MIS09A.2

VICESOSRX as generated by the terminal.

MPAK-COMMON COMPONENT:

octet 1-3:

sender

octet 4-6:

addressee: the MOBITEK network

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 0 1 1 0 1

TYPE DEPENDENT COMPONENT does not exist.

Subpart

Repro: -

A 292 51333

Cantel Mobitex -

No. 51/1056 - A 296 5171/2 Ue		
Issue Date	Issued	File No.
1990-02-19	A	MTS09A.2

6.14 SOSRX (cancel of emergency message re-direction):

Designated sender:

Terminal subscription or personal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The subscriber which is the emergency receiver wishes to resume reception of emergency messages (SOSINFO).

The network's normal action when receiving the packet:

The network registers that emergency messages should be sent to the emergency receiver.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet. If the operation did not succeed, this should be shown to the user.

Length of the packet:

8 octets.

Revised:

Revised:

Cantel Mobitex -

No. 51/1056 - A 296 5171/2 Ue
 Version: 1990-02-19 Rev A P: P.4
 MTS09A.2

SOSRX as generated by the terminal:

MPAK-COMMON COMPONENT:

octet 1-3:

--	--	--	--	--	--	--	--	--	--

 sender

octet 4-6:

--	--	--	--	--	--	--	--	--	--

 addressee: the MOBITE network

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	1	0	0	1	1	1	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT does not exist.

Blanket

Reprod

A 292.5153-3

Cantel Mobitex-

Doc No.	51/1056 - A 296 5171/2 Ue
Docum. Date	1990-02-19
Docum. No.	A
Docum. Title	MTS09A.2

6.15 GROUPLIST (list of group MAN):

Designated sender:

The network.

Designated addressee:

The terminal subscription.

Raised flags:

MAILBOX_F

This packet can be stored in the network's mailbox if the addressee cannot be reached even though MAILBOX is not included in the subscription service.

Criteria for generating the packet:

Changes in the subscriber information have taken place, the mobile terminal has sent 'BORN' or the fixed terminal is activated for the first time.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

Replace former list of group numbers with this new group list.

Length of the packet:

54 octets.

Buildout

Reprint

A 292 5153

Cantel Mobitex

51/1056 - A 296 5171/2 Ue
 1990-02-19 A MTS09A.2

GROUPLIST as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3: sender: the MOBITEK network

octet 4-6: addressee

octet 7: 0 0 0 0 0 0 0 X

octet 8: 1 1 0 0 1 1 1 1

X = '0' or '1'

TYPE DEPENDENT COMPONENT:

octet 9: number of MAN

octet 10-12: MAN 1 (All Terminals Group)

octet 13-15: MAN 2

octet 16-18: MAN 3

octet 19-21: MAN 4

octet 22-24: MAN 5

octet 25-27: MAN 6

octet 28-30: MAN 7

octet 31-33: MAN 8

octet 34-36: MAN 9

octet 37-39: MAN 10

Bidders

Expos

A 29251533

Cantel Mobitex-

No. No.	51/1056 - A 296	5171/2 Ue
Start Date	1990-02-19	Rev. A
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octet 40-42:	<div></div>	MAN 11	<div></div>
octet 43-45:	<div></div>	MAN 12	<div></div>
octet 46-48:	<div></div>	MAN 13	<div></div>
octet 49-51:	<div></div>	MAN 14	<div></div>
octet 52-54:	<div></div>	MAN 15	<div></div>

Note: MAN 1 (octets 10-12) are used for the All Terminals Group number.

Bidkart

Regres

Cantel Mobitex -

51/1056 - A 296 5171/2 Ue
1990-02-19 A MTS09A.2

6.16 FLEXREQ (list of logged-in MAN requested):

Designated sender:

The network.

Designated addressee:

Terminal subscription.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network requires current information about which subscription that are logged-in at the terminal.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal sends current information in the 'FLEXLIST' packet.

Length of the packet:

8 octets.

Holdings

Report

A 292 51553

Cantel Mobitex-

51/1056 - A 296 5171/2 Ue

Action Date
1990-02-19

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A

File Name
MTS09A.2

FLEXREQ as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network

octet 4-6:

addressee

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 1 0 0 0 0

TYPE DEPENDENT COMPONENT does not exist.

Blanket

Report

A 292 51535

Cantel Mobitex-

SI/1056 - A 296	SI71/2 Ue
1990-02-19	A MTS09A.2

6.17 FLEXLIST (list of personal subscriptions logged-in at the terminal)**Designated sender:**

The network or terminal subscription.

Designated addressee:

The terminal subscription or the network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The network: Changes in information have occurred.

Terminal: The terminal has received 'FLEXREQ'.

The network's normal action when receiving the packet:

The network checks the list of personal subscriptions logged-in at the terminal.

The terminal's normal action when receiving the packet:

Replace former list of personal subscriptions with the new list.

Length of the packet:

30 octets.

Bulker

Reprod

Cantel Mobitex

51/1056 - A 296 5171/2 Ue
 1990-02-19 A MTS09A.2

FLEXLIST as generated by terminal and network:

MPAK-COMMON COMPONENT:

octet 1-3:		sender	
octet 4-6:		addressee	
octet 7:	0 0 0	0 0 0 0 0	
octet 8:	1 1 0	1 0 0 0 1	

TYPE DEPENDENT COMPONENT:

octet 9:	number of MAN	
octet 10-12:	MAN 1	
octet 13-15:	MAN 2	
octet 16-18:	MAN 3	
octet 19-21:	MAN 4	
octet 22-24:	MAN 5	
octet 25-27:	MAN 6	
octet 28-30:	MAN 7	

No more than 7 subscriptions may be logged-in to one and the same terminal.

Bulknet

Keynet

A 292 51554

Cantel Mobitex-

No. No		51/1056 - A 296 5171/2 Ue	
Service Date	Rev	F. File	
1990-02-19	A	MTS09A.2	

6.18 INFOREQ (terminal information requested):

Designated sender:

The network.

Designated addressee:

Mobile terminal subscription.

Raised flags:

No flags raised.

Criteria for generating the packet:

The network requires updating on terminal information.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet.

The terminal sends 'INFO'.

Length of the packet:

8 octets.

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Repro:

A 292 51532

Cantel Mobitex-

Doc. No. 51/1056 - A 296 5171/2 Ue

Issued Date 1990-02-19

Rev. A

File Name MTS09A.2

INFOREQ as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network

octet 4-6:

addressee

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 1 0 0 1 0

TYPE DEPENDENT COMPONENT does not exist.

Bildkurz:

Reproc:

A 392 51553

Cantel Mobitex

No.	51/1056 - A 296 5171/2 Ue
Date	1990-02-19
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File	MTS09A.2

6.19 INFO (terminal information):

Designated sender:

Mobile terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal has received 'INPOREQ'.

The network's normal action when receiving the packet:

The network updates the register.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

The length may vary between 44 and 46 octets.

Blank

Repeat

A 1991 51573

Cantel Mobitex-

51/1056 - A 296 5171/2 Ue
 1990-02-19 A MTS09A.2

INFO as generated by the terminal:

MPAK-COMMON COMPONENT:

octet 1-3: sender
 octet 4-6: addressee: the MOBITEK network
 octet 7: 0 0 0 0 0 0 0 0
 octet 8: 1 1 0 1 0 0 1 1

TYPE DEPENDENT COMPONENT:

octet 9: number of MAN (personal subs)
 octet 10-12: MAN 1 (personal subs)
 octet 13-15: MAN 2 (personal subs)
 octet 16-18: MAN 3 (personal subs)
 octet 19-21: MAN 4 (personal subs)
 octet 22-24: MAN 5 (personal subs)
 octet 25-27: MAN 6 (personal subs)
 octet 28-30: MAN 7 (personal subs)
 octet 31-44: technical information
 octet 45 etc. channel class dep. information

Bildart

Repro

A 292 51533

Cantel Mobitex

Sr. No. 51/1056 - A 296 5171/2 Ue
 Exam. Date 1990-02-19 Rev. A P. No. MTS09A.2

technical information : 14 octets.

This field states whether the mobile terminal is equipped with technical media for generating and presenting different traffic types. The field also describes the characteristics of the radio station. The information to be stated in this field must be provided when opening the subscription.

	8	7	6	5	4	3	2	1	
octet 1:	med:generate connection								(no=0,yes=1)
octet 2:	med: receive connection								(no=0,yes=1)
octet 3:	media: present text								(no=0,yes=1)
octet 4:	partially active in MBX								(no=0)See NOTE
octet 5:	radio:superv.sign. loop								(no=0)See NOTE
octet 6:	radio: terminal type								(Terminal type=3)
octet 7:	radio: working method								(duplex=1, 2-frequency simplex=2)
octet 8:	radio: output power								(WATT)
octet 9:	radio:rx/tx switch time								(ms)
octet 10:	radio: FBI								See NOTE
octet 11:	radio: priority								(4 levels, 1-4)
octet 12:	0 0 0 0 0 0 0 0								(spare)
octet 13:	0 0 0 0 0 0 0 0								(spare)
octet 14:	radio: channel class								(channel class= 4 or 5)

NOTE: Octet 4-5 : Partially active terminals and speech quality supervisory signal are not used.
 FBI (frequency band information, octet 10) is defined in reference R1-06.

Billhart

Expro

51/1056 - A 296 5171/2 Ue		
Date: Date	Rev	Fl. File
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This field states which radio channels the relevant mobile equipment can use. There are 2 possible channel classes that may be used; channel class 4 or 5.

Full band station with independent channels for receiving and transmitting channels.

No channel class dependent information is required.

Full band station with fixed duplex spacing. The duplex spacing is given as the channel difference.

octet 1-2:

Duplex spacing (channels)

All figures are binary coded into two octets. The most significant bit is bit 8 in the first octet. The least significant bit is bit 1 in the second octet.

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6.20 TIME (time information):

Designated sender:

The network.

Designated addressee:

The terminal subscription or group.

Raised flags:

No raised flags.

Criteria for generating the packet:

When traffic load permits, the network sends the network time information to the terminals.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The time information packet from the network may only be used as a calendar clock function in the terminal's application.

Length of the packet:

11 octets.

Blanket

Revised

A 296 5153-3

Cantel Mobitex -

Doc No	51/1056 - A 296 5171/2 Use	
Creation Date	1990-02-19	Rev A
File No	MTS09A.2	

TIME as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEX network							
-----------------------------	--	--	--	--	--	--	--

octet 4-6:

addressee							
-----------	--	--	--	--	--	--	--

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	1	0	1	0	1	0	0
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-11:

time							
------	--	--	--	--	--	--	--

Bilder:

Repro:

A 296 51533

Cantel Mobitex -

No. 51/1056 - A 296	5171/2 Ue
Issue Date 1990-02-19	Rev A P. 5.4 MTS09A.2

6.21 AREALIST (area ID information)

Designated sender:

The network.

Designated addressee:

The mobile terminal subscription.

Raised flags:

MAILBOX_F

This packet can be placed in the network mailbox if the addressee cannot be reached even if MAILBOX is not included in the subscription.

Criteria for generating the packet:

Changes in the subscriber information concerning the operational areas have taken place or the mobile terminal has sent 'BORN'.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal should forward the area list information to the data link layer.

Length of the packet:

17 octets.

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Cantel Mobitex

No. 51/1056 - A 296 5171/2 Ue
 Creation Date 1990-02-19 Rev. A File Name MTS09A.2

AREALIST as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the MOBITEK network							
-----------------------------	--	--	--	--	--	--	--

octet 4-6:

addressee							
-----------	--	--	--	--	--	--	--

octet 7:

0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---

octet 8:

1	1	0	1	0	1	0	1
---	---	---	---	---	---	---	---

TYPE DEPENDENT COMPONENT:

octet 9-15:

63								0							
Bitmap															

octet 16:

Command (0-255)							
-----------------	--	--	--	--	--	--	--

Bitmap : Bitmap representing the area ID's.
 The bitmap should be transferred to the data link layer.

0 = not valid area ID.
 1 = valid area ID.

Command : Mobile performance in areas which are indicated as not valid in the bitmap. The command should also be transferred to the data link layer.

0 = not valid area ID's must not be used by the terminal.

1 = not valid area ID's may be used, but traffic may be charged a different fee.

Blockart

Reproce

A 292 5155-3

Cantel Mobitex

No. 51/1056 - A 296 5171/2 Ue						
<table border="1"> <tr> <td>Version Date</td> <td>Rev</td> <td>File Name</td> </tr> <tr> <td>1990-02-19</td> <td>A</td> <td>MTS09A.2</td> </tr> </table>	Version Date	Rev	File Name	1990-02-19	A	MTS09A.2
Version Date	Rev	File Name				
1990-02-19	A	MTS09A.2				

6.22 ESNREQ (Electronic Serial Number requested)

Designated sender:

The network.

Designated addressee:

Mobile terminal subscription.

Raised flags:

No flags raised.

Criteria for generating the packet:

The network requests a check of the electronic serial number.

The network's normal action when receiving the packet:

The network does not normally receive the packet.

The terminal's normal action when receiving the packet:

The terminal sends 'ESNINFO'.

Length of the packet:

8 octets.

Blanket

Reprod

Cantel Mobitex -

Mr. No
51/1056 - A 296 5171/2 Ue

Document Date
1990-02-19

Rev
A

File No
MTS09A.2

ESNREQ as generated by the network:

MPAK-COMMON COMPONENT:

octet 1-3: sender: the MOBITEK network

octet 4-6: addressee

octet 7: 0 0 0 0 0 0 0 0

octet 8: 1 1 0 1 0 1 1 0

TYPE DEPENDENT COMPONENT does not exist.

Blanket

Report

A 292 51530

Cantel Mobitex-

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6.23 ESNINFO (electronic serial number information:)

Designated sender:

Mobile terminal subscription.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

The terminal has received 'ESNREQ'.

The network's normal action when receiving the packet:

The network checks the electronic serial number.

The terminal's normal action when receiving the packet:

The terminal does not normally receive the packet.

Length of the packet:

12 octets.

Blockart

Reprod

A:001 5153-3

Cantel Mobitex-

Rev. No. 51/1056 - A 296 5171/2 Ue
 Creation Date 1990-02-19 1 Rev. A
 P. 2. d MTS09A.2

ESNINFO as generated by the terminal:

MPAK-COMMON COMPONENT:

octet 1-3:

sender

octet 4-6:

addressee: the MOBITEK network

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 1 0 1 1 1

TYPE DEPENDENT COMPONENT:

octet 9 -12:

ESN

ESN 4 octets.
 This field states the electronic serial number.
 For the ESN specification, please refer to R1-06.

Disksort

Reprint

A 292 51532

Cantel Mobitex

51/1056 - A 296 5171/2 Ue
 1990-02-19 A MTS09A.2

7 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 5, 12, 28, 30, 70, 80, 81, 82, 92, 108, 117
 RI-08, 9, 13, 17, 21, 25, 27, 29, 31

Below are the reference designations listed.

Reference	Section
RI-01	Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

Outiders

Refered

REQUIREMENT SPECIFICATIONS 1(94)

Upper Prepared ET/SYS GCn	FACILITATING - Current Response ET/SYS GCn	No. 30 52/1056 - A 296 5171/2 Ue
Diskette/Goldcard - One response prepared ET/SYSC STT SW		Date Recd Date Recd 1990-02-23 A
Reference	Title MOBITEX Network layer for terminals Appendix B. DIALOGUES	Pg. No. MTS09B.2

Cantel Mobitex™

ABSTRACT

This document describes the dialogues between terminals and the MOBITEX network.

Combinations of dialogues are not considered in this document and instead, the relevant typical cases in communication to/from terminals are described.

Cantel Mobitex -

No. 52/1056 - A 296 5171/2 Ue
 Date 1990-02-23 Rev A P. 6.4
 MTS09B.2

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Repton

A-92 51533

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1 INTRODUCTION

The dialogues are divided into the following groups :

PSUBCOM - packet switched subscriber communication

- Internal traffic without address list (*)
- Internal traffic with address list (*)
- Internal traffic to groups (*)
- External traffic

* = TEXT, DATA, STATUS, HP-DATA

PSOSCOM - Packet switched emergency communication

- Emergency signal/emergency message (SOS, SOSINFO)
- Emergency acknowledgement (SOSACK)

CSUBCOM - Circuit switched communication

- Connection and emergency connection (*)
- External connection (*)
- Group connection (*)
- Additional connection (*)
- Line test (LINEON, LINEOFF)

* = CONREQ, ADDCONREQ, SOSCONREQ, EXTCONREQ, CONFAST, ADDCONFAST, SOSCONFAST, LINSEL

Booklet

Reprod

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Cantel Mobitex -

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DTERSERV - Data terminal service communication

SUBSCRIPTION STATUS

- Log-in (LOGINREQ, LOGINGRA, LOGINREF)
- Log-out (LOGOUT, LOGOUTORD)

TERMINAL STATUS

- Activation (ACTIVE)
- Inactivation (INACTIVE)
- DIE / LIVE
- Roaming (ROAM, ROAMORD)
- Re-direction of emergency receiver (VICESOSRX)
- Cancel of re-direction (SOSRX)

TERMINAL INFORMATION

- Updating groups (GROUPLIST)
- Updating area IDs (AREALIST)
- Updating personal subscriptions (FLEXREQ, FLEXLIST)
- Technical information (INFOREQ, INFO)
- Time information (TIME)
- ESN request, ESN information (ESNREQ, ESNINFO)

Budget

Reprod

A 292 51533

Cantel Mobitex

No. No	52/1056 - A 296 5171/2 Ue
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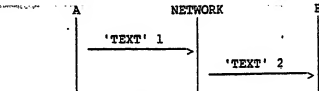
2 INTERNAL TRAFFIC WITHOUT ADDRESS LIST

The dialogues are identical for all packet switched internal traffic without address list. The 'TEXT' packet in the following dialogues can be replaced by 'DATA', 'HPDATA' or 'STATUS', without any changes in the dialogue.

The common factor for all dialogues in internal traffic is that the original packet ('TEXT' 1) is generated by the A party according to the criteria and with the structure described in Appendix A. Reservations are stated for the respective dialogues.

Dialogue 2.1:

B-party is active and can be reached by the network.



'TEXT' 2 is identical to 'TEXT' 1.

Bildtext

Repton

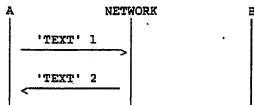
Cantel Mobitex -

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Dialogue 2.2:

'TEXT' 1 has been generated with subscriber flag MAILBOX F=0, which indicates that the packet should not be stored in the network mailbox.

The B-party is not available at the moment.



'TEXT' 2 is returned with traffic state = NO_TRANSFER

or

'TEXT' 2 is returned with traffic state = BUSY

NOTE : This dialogue occurs also when MAILBOX F=1 and the packet cannot not be stored in the mailbox. A packet is not stored in the network mailbox if MAILBOX is not included in B-party's subscription service.

Reliabil

Superv

A 391 5133.3

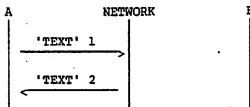
Cantel Mobitex

No. 52/1056 - A 296 5171/2 Ue
Date: 1990-02-23 A
File: MTS09B.2

Dialogue 2.3:

'TEXT' 1 has subscriber flag MAILBOX_F=1; the packet may be stored in the mailbox.

The B party is not available at the moment.



A copy of 'TEXT' 1 is stored in the network mailbox.
'TEXT' 2 has traffic state = IN_MAIL.

Packets that are stored in the mailbox are sent to the addressee in accordance with dialogue 15.2.

NOTE : If MAILBOX is required by the A-party but MAILBOX is not included in the B-party's subscription, the packet is returned in accordance with dialogue 2.2.

Reflex

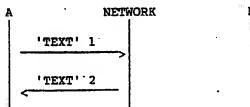
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Cantel Mobitex

Sr. No. 52/1056 - A 296 5171/2 Ue
 Date: Date 1990-02-23 Rev A Pl. File MTS09B.2

Dialogue 2.4:

The network has not switched the packet.



- a) The reason why the transfer cannot be performed may be
- 1) B party does not exist
 - 2) the transfer is not permitted due to the A party's subscription
 - 3) the transfer is not permitted due to the B party's subscription.

'TEXT' 2 is then returned with traffic state = ILLEGAL

- b) The network is overloaded.

'TEXT' 2 is then returned with traffic state = CONGEST

- c) A technical fault has occurred in the network. The packet cannot be switched.

'TEXT' 2 is then returned with traffic state = ERROR

Blockers

Reprod

Cantel Mobitex

St. No. 52/1056 - A 296 5171/2 Ue
 Date 1990-02-23 Rev. A P. No. MTS09B.2

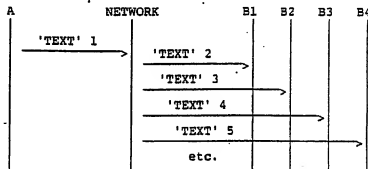
3 INTERNAL TRAFFIC WITH ADDRESS LIST

The dialogues are identical for all packet switched internal traffic with address list. The 'TEXT' packet in the following dialogues can thus be replaced by 'DATA', 'HPDATA' or 'STATUS' without any changes in the dialogue.

The common factor for all dialogue in internal traffic is that the the original packet ('TEXT' 1) is generated by the A-party according to the criteria and with the structure described in Appendix A. Reservations are stated for the respective dialogues.

The network immediately converts 'TEXT' 1 with address list to the number of packets stated in the address list. Each one of these packets are identical but with different addressee.

Dialogue 3.1:



'TEXT'2 - 'TEXT'5 etc does not contain an address list.

Blanket

Reprod

A 297 5153.3

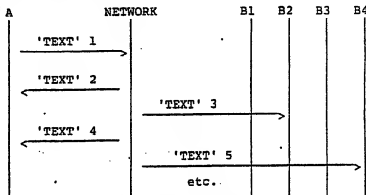
Cantel Mobitex

Doc No: 52/1056 - A 296 5171/2 Ue
 Doc Date: 1990-02-23 Rev: A Ed: Ene
 MTS09B.2

Dialogue 3.2:

'TEXT'1 contains an address list and has subscription flag MAILBOX_F=0; the packet should not be stored in the mailbox.

One or more of the B-parties (B1 and B3 in the example) are currently not available.



'TEXT'2 - 'TEXT'5 etc in the dialogue does not contain an address list but have each been allocated an address from the address list.

'TEXT' 2 and 'TEXT'4 has traffic state = NO_TRANSFER or traffic state = BUSY.

NOTE : This dialogue occurs even if MAILBOX is required but the packet cannot not be stored in the mailbox.

Bidders

Report

A-29 5153-3

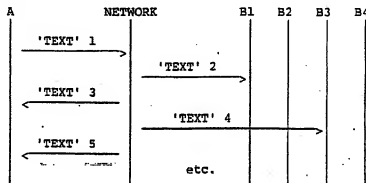
Cantel Mobitex

Doc No 52/1056 - A 296 5171/2 Ue
Version Date 1990-02-23 Rev A File MTS09B.2

Dialogue 3.3:

'TEXT'1 contains an address list and has subscription flag MAILBOX_F = 1.

One or more of the B parties (B2 and B4 in the example) are currently not available.



'TEXT'2 - 'TEXT'5 etc in the dialogue does not contain an address list but have each been allocated an address from the address list.

Copies of the packet 'TEXT'3 and 'TEXT'5 are stored in the network mailbox.

'TEXT' 3 and 'TEXT' 5 have traffic state = IN_MAIL.

NOTE: If MAILBOX is required by the A-party but the mailbox service is not included in the B-party's subscription, the packet is returned in the same way as in dialogue 3.2.

Buildout

Reproc

A 297 51553

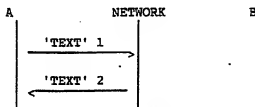
Cantel Mobitex

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1990-02-23
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Doc File
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Dialogue 3.4

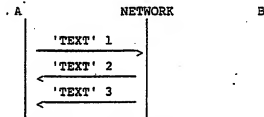
The network has not switched the packet.

Case 1 :



This dialogue shows that 'TEXT'2 is returned before the packet was copied. 'TEXT'2 contains the address list.

Case 2 :



This dialogue shows that 'TEXT'2 and 'TEXT'3 is returned after the original packet has been copied. 'TEXT'2 and 'TEXT'3 does not contain an addresslist.

- a) The reason why the transfer cannot be performed may be
 - 1) B party does not exist
 - 2) the transfer is not permitted due to the A party's subscription
 - 3) the transfer is not permitted due to the B party's subscription.

'TEXT'2 (3) is then returned with traffic state = ILLEGAL.

- b) The network is overloaded.

'TEXT'2 (3) is then returned with traffic state = CONGEST

- c) A technical error has occurred in the network.

'TEXT'2 (3) is then returned with traffic state = ERROR

Editors

Repro

Cantel Mobitex

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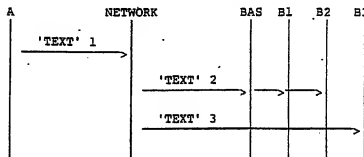
4 INTERNAL TRAFFIC TO GROUPS

The dialogues are identical for all packet switched internal traffic to groups. The 'TEXT' packets in the following dialogue can be replaced by 'DATA', 'HPDATA' or 'STATUS' without any changes in the dialogue common factor for all dialogue in internal traffic is that the original packet ('TEXT' 1) is generated by the A-party according to the criteria and with the structure shown in the Appendix A.

Since traffic to groups can affect a considerable number of subscriptions, the A-party is not notified if any of the B-parties is not available.

Dialogue 4.1

Packets to groups are routed to a limited number of predetermined base radio stations and fixed terminals.



In this example, BASE is a predetermined base radio station. B1 and B2 are mobile terminals in the group which are operating under BASE. B3 is a fixed terminal in the group.

'TEXT' 2 and 3 are copies of 'TEXT' 1.

Booklet

Revised

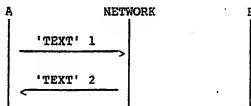
A 592 51533

Cantel Mobitex-

No.	52/1056 - A 296	5171/2 Ue
Issue Date	1990-02-23	Rev. A
		Rev. F. MTS09B.2

Dialogue 4.2:

The network cannot transfer the packet.



- a) The reason why the transfer cannot take place may be that the transfer is not permitted in the A party's subscription or that the addressed group does not exist.

'TEXT' 2 is returned with traffic state = ILLEGAL.

- b) The network is overloaded.

'TEXT' 2 is returned with traffic state = CONGEST

- c) A technical fault has occurred.

'TEXT' 2 is returned with traffic state = ERROR

Sticker:

Reprod

A 292 11530

Cantel Mobitex

No. 52/1056 - A 296 5171/2 Ue
Date 1990-02-23 Rev. A File MTS09B.2

5 EXTERNAL TRAFFIC

External traffic applies to traffic with different external telecommunications networks. Since the gateways to these networks are not yet fully specified, these dialogues are excluded.

Printers

Reprod

A 002 51522

Cantel Mobitex

Mr. No.	52/1056 - A 296 5171/2 Ue
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Current Date	Rev	File No.
1990-02-23	A	MTS09B.2

6 EMERGENCY SIGNAL/EMERGENCY MESSAGE

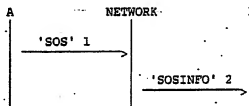
The 'SOS' packet is generated by the A-party according to the criteria and with the structure described in the Appendix A.

The 'SOSINFO' packet is generated by the network according to the criteria and with the structure according to Appendix A.

The B-party in these examples are the predestinated emergency receiver.

Dialogue 6.1:

The B-party is active and can be accessed by the network.

**Dialogue 6.2:**

If both the ordinary and the alternative emergency addresses are inactive, no normal transfer of the packet can be carried out. The emergency message SOSINFO will then be transmitted by the base station where the SOS entered the network as shown in dialogue 6.4.

Buildern

Reprint

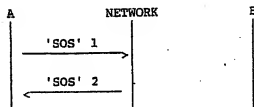
A 296 51639

Cantel Mobitex

Mr. No.	52/1056 - A 296 5171/2 Ue
Document Date	1990-02-23
Rev.	A
File No.	MTS09B.2

Dialogue 6.3:

The network has not been able to transfer the packet to the emergency receiver.



The packet contains incorrect information, for example the information about the A party has been incorrectly stated.

'SOS' 2 then has status = ILLEGAL

Bildschirm

Repro

A 291 51533

Cantel Mobitex-

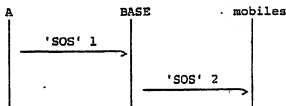
No. 52/1056	- A 296	5171/2 Ue
Creation Date 1990-02-23	Rev A	File Name MTS09B.2

Dialogue 6.4:

A technical fault has occurred in the network.

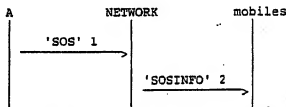
The emergency signal (SOS) or the emergency message (SOSINFO) is re-transmitted by the base radio station where the emergency signal entered the network. The emergency signal or emergency message is addressed to the All Terminals Group MAN.

CASE 1



'SOS' 2 is re-transmitted with traffic state = OK. 'SOS' 2 is addressed to All Terminals Group MAN.

CASE 2



'SOSINFO' 2 is re-transmitted with traffic state = OK. 'SOSINFO' 2 is addressed to the All Terminals Group MAN.

Disksave

Reprint

A 292 5155-3

Cantel Mobitex

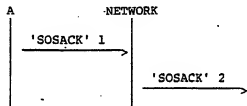
No. 52/1056 - A 296 5171/2 Ue
 Date: 1990-02-23 Rev. A Ver. 1.0
 MTS09B.2

7 EMERGENCY ACKNOWLEDGEMENT

The emergency acknowledge (SOSACK) is generated by the A party according to the criteria and the structure given in Appendix A.

Dialogue 7.1:

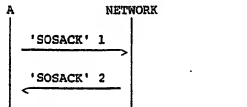
The B-party is active and can be reached by the network.



'SOSACK' 1 and 'SOSACK' 2 are identical.

Dialogue 7.2:

The B-party is can not be reached.



'SOSACK' 2 is returned with traffic state = NO_TRANSFER

'SOSACK' cannot be stored in the network mailbox.

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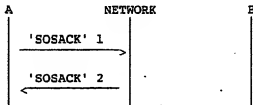
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Doc No		Rev A
Doc No		Rev A

Dialogue 7.3:

The network cannot transfer the packet.



a) The reason why the transfer cannot take place could be that the B-party does not exist.

'SOSACK' 2 is then returned with traffic state = ILLEGAL

b) The network is overloaded.

'SOSACK' 2 is then returned with traffic state = CONGEST

c) A technical fault has occurred.

'SOSACK' 2 is then returned with traffic state = ERROR

Illegals

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Dr No
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Order Date 1990-02-23 Rev A T. P. # MTS09B.2

8 CIRCUIT SWITCHED CONNECTION/EMERGENCY CONNECTION

In following chapters are CON**R equal to

CONREQ
ADDCONREQ
SOSCONREQ
EXTCONREQ

CON**F equal to

CONFAST
ADDCONFAST
SOSCONFAST

CON*** equal to

CONREQ
ADDCONREQ
SOSCONREQ
EXTCONREQ
CONFAST
ADDCONFAST
SOSCONFAST

NOTE 1: The terminal must not enter Speech Mode until

- a) CON*** sent successfully
- or
- b) CON**R received and HOOK-OFF received from application layer and CONREA sent successfully
- or
- c) CON**F received and HOOK-OFF received from application layer
- or
- d) CONORD received and HOOK-OFF received from application layers.

NOTE 2: The Receive/Transmit switch of the mobile terminal operating in two-frequency simplex must not be operational until Speech Mode has been entered.

NOTE 3: HOOK-OFF without a previous request for a circuit switched connection shall result in an error alarm and CONREA shall not be sent to the network.
HOOK-ON without a previous request for a circuit switched connection shall not result in a DISCON packet.

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NOTE 4: If there is no HOOK-OFF within 60 seconds from the receiving of CON**R, the connection shall be concluded by sending a DISCON.

If there is no HOOK-OFF within 60 seconds after the reception of CONORD, the terminal shall return to normal idle state without sending DISCON.

If there is no HOOK-OFF within 10 seconds from the receiving of CON**P, the connection shall be concluded by sending a DISCON.

NOTE 5: The network layer should send Speech-ON to the data link layer when

- a) CON*** sent successfully
- or
- b) CON**R received and HOOK-OFF received from application layer and CONREA sent successfully
- or
- c) CON**F received
- or
- d) CONORD received.

NOTE 6: The terminal should leave Speech_Mode and send Speech-OFF to the data link layer when a DISCON is transmitted by the link layer or when a DISCON is returned by the link layer as 'not transmitted'.

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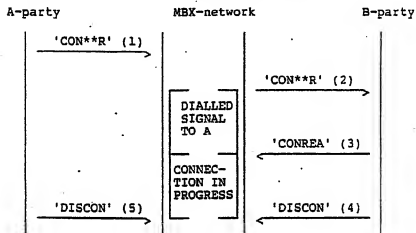
No. 52/1056	- A 296	5171/2 Ue
Decom. Date 1990-02-23	Rev A	File No. MTS09B.2

8.1 Ordinary circuit switched connection

Dialogue 8.1.1

A party: Prot_1
B party: Prot_1 or Prot_2A

The B party is active and generate HOOK-OFF.



COMMENT : The connection identity which the A party selects for CON**R (1) shall be included in all packets included in this connection (2-5).

Content of packets :

CON**R (1)	CON**R (2)
Sender: : A-PARTY	Sender: A-PARTY
Addressee: B-PARTY	Addressee: B-PARTY
Status: OK	Status: OK
DIGITAL F: 0	DIGITAL F: 0
EXTERN F: 0	EXTERN F: 0
Line n ^o .: 0	Line n ^o .: Z
Conn. I.D. Y	Conn. I.D. Y

CONREA (3)	DISCON (4)
Sender: B-PARTY	Sender: B-PARTY
Addressee: A-PARTY	Addressee: A-PARTY
Status: OK	Status: OK
DIGITAL F: 0	DIGITAL F: 0
EXTERN F: 0	EXTERN F: 0
Line n ^o .: Z	Line n ^o .: Z
Conn. I.D. Y	Conn. I.D. Y

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Mr. No.	52/1056 - A 296 5171/2 Ue	
Creation Date	Rev	Pl. F.2
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DISCON (5)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. Y

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52/1056 - A 296 5171/2 Ue

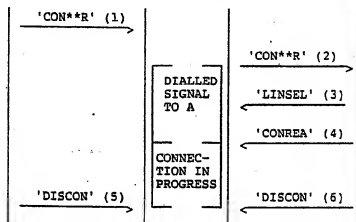
1990-02-23 A MTS09B.2

Dialogue 8.1.2

A party: Prot_1
B party: Prot_2B

The B party is active and generate HOOK-OFF.

A-party MBX-network B-party



COMMENT : The connection identity which the A party selects for CON**R (1) shall be included in all relevant packets included in the connection (2-6).

Content of packets :

CON**R (1)

Sender: : A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: dont care
Conn. I.D. Y

LINSEL (3)

Sender: B-PARTY
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

CONREA (4)

Sender: B-PARTY
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

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DISCON (5)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

DISCON (6)

Sender: B-PARTY
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

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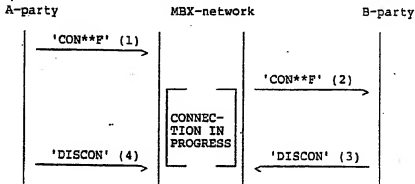
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Docum. Date 1990-02-23 Rev. A FC. F. 2 MTS09B.2

Dialogue 8.1.3

A party: Prot_1
B party: Prot_1 or Prot_2A

The B party is active and generate HOOK-OFF.



COMMENT : The connection identity which the A party selects for CON**F (1) shall be included in all relevant packets included in the connection (2-4)

Content of packets:

CON**F (1)

Sender: : A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line n.º.: 0
Conn. I.D. Y

CON**F (2)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line n.º.: Z
Conn. I.D. Y

DISCON (3)

Sender: B-PARTY
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line n.º.: Z
Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line n.º.: 0
Conn. I.D. Y

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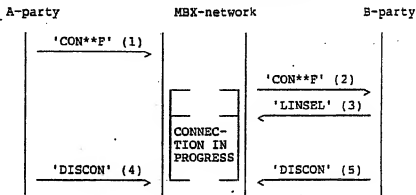
Cantel Mobitex

Doc. No. 52/1056 - A 296 5171/2 Use
 Date: 1990-02-23 Title: A File No: MTS09B.2

Dialogue 8.1.4

A party: Prot 1
 B party: Prot_2B

The B party is active and generate HOOK-OFF.



COMMENT : The connection identity which the A party selects for CON**F (1) shall be included in all relevant packets included in the connection (2-5).

Content of packets:

CON**F (1)

Sender: : A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**F (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: dont care
 Conn. I.D. Y

LINSEL (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

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DISCON (5)

```

Sender:      B-PARTY
Addressee:   A-PARTY
Status:      OK
DIGITAL F:   0
EXTERN F:    0
Line n $\bar{o}$ .:   Z
Conn. I.D.   Y

```

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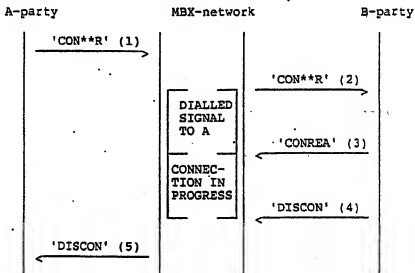
52/1056 - A 296 5171/2 Ue
 1990-02-23 A MTS09B.2

8.2 B-party disconnects the call

Dialogue 8.2.1

A party: Prot_1
 B party: Prot_1 or Prot_2A

The B party is active and generate HOOK-OFF. The B party disconnects with HOOK-ON.



CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

CONREA (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

DISCON (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

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DISCON (5)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

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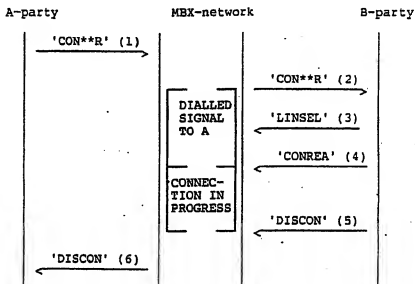
Cantel Mobitex

No. 52/1056 - A 296 5171/2_Ue
 Date: 1990-02-23 Rev. A P. No. MTS09B.2

Dialogue 8.2.2

A party: Prot_1
 B party: Prot_2B

The B party is active and generate HOOK-OFF. The B-party disconnects with HOOK-ON.



CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: dont care
 Conn. I.D. Y

LINSEL (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

CONREA (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

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DISCON (5)

```

Sender:      B-PARTY
Addressee:   A-PARTY
Status:      OK
DIGITAL F:   0
EXTERN F:    0
Line no.:    Z
Conn. I.D.   Y

```

DISCON (6)

```

Sender:      B-PARTY
Addressee:   A-PARTY
Status:      OK
DIGITAL F:   0
EXTERN F:    0
Line n̄o.:    0
Conn. I.D.   Y

```

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Figure 9-4

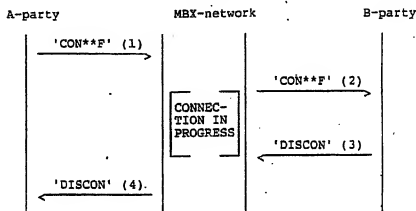
Cantel Mobitex-

Doc. No. 52/1056 - A 296 5171/2 Ue
 Revision Date 1990-02-23 Rev. A To: P.S. MTS09B.2

Dialogue 8.2.3

A party: Prot_1
 B party: Prot_1 or Prot_2A

The B party is active and generate HOOK-OFF. The B-party disconnects the call with HOOK-ON.



CON**F (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**F (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

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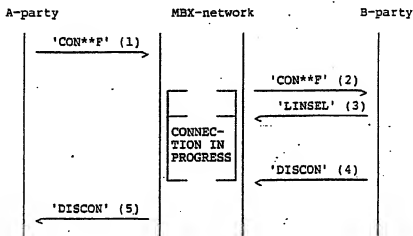
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 Version Date 1 Rev P. 2.0
 1990-02-23 A MTS09B.2

Dialogue 8.2.4

A party: Prot 1
 B party: Prot 2B

The B party is active and generate HOOK-OFF. The B-party disconnects the call with HOOK-ON.



CON**P (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**P (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: dont care
 Conn. I.D. Y

LINSEL (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

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Version - Date 1990-02-23 A

Rev. File MTS09B.2

DISCON (5)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nG.: 0
 Conn. I.D. Y

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 1990-02-23 A MTS09B.2

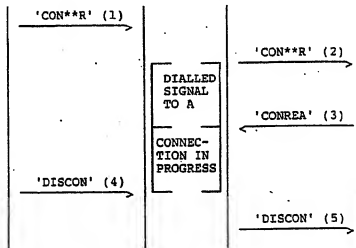
8.3 A-party disconnects the call.

Dialogue 8.3.1

A party: Prot_1
 B party: Prot_1 or Prot_2A

The B party is active and generate HOOK-OFF. The A-party disconnects the call with HOOK-ON.

A-party MBX-network B-party



CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 2
 Conn. I.D. Y

CONREA (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 2
 Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

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DISCON (5)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nC.: Z
 Conn. I.D. Y

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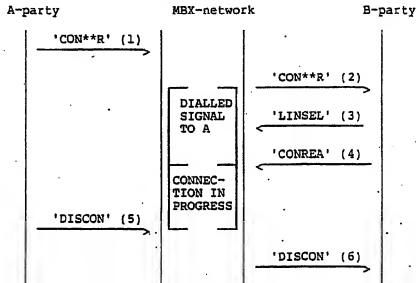
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 Date: 1990-02-23 Rev. A F. P. MTS09B.2

Dialogue 8.3.2

A party: Prot_1
 B party: Prot_2B

The B party is active and generate HOOK-OFF. The A-party disconnects the call with HOOK-ON.



CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: dont care
 Conn. I.D. Y

LINSEL (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

CONREA (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

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Cantel Mobitex -

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	A	Rev
		HTS09B.2

DISCON (5)

Sender: A-PARTY
Addressee: B-PARTY

Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

DISCON (6)

Sender: A-PARTY
Addressee: B-PARTY

Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. .Y

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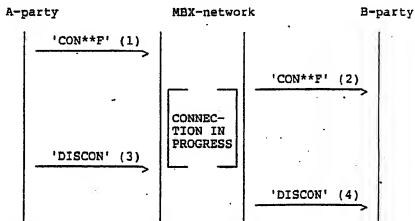
Cantel Mobitex-

52/1056 - A 296 5171/2 Ue
 1990-02-23 A MTS09B.2

Dialogue 8.3.3

A party: Prot_1
 B party: Prot_1 or Prot_2A

The B party is active and generate HOOK-OFF. The A-party disconnects the call with HOOK-ON.



CON**P (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**P (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (3)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

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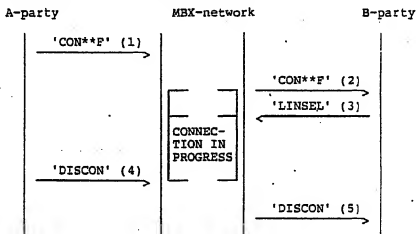
52/1056 - A 296 5171/2 Ue

1990-02-23 A MTS09B.2

Dialogue 8.3.4

A party: Prot_1
B party: Prot_2B

The B party is active and generate HOOK-OFF. The A-party disconnects the call with HOOK-ON.



CON**F (1)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON**F (2)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: dont care
Conn. I.D. Y

LINSEL (3)

Sender: B-PARTY
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

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52/1056 - A 296 5171/2 Ue

1990-02-23 A MT509B.2

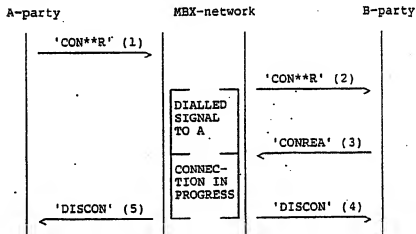
8.4 The network disconnects the call.

The network disconnects a call only in exceptional cases. This occurs after a 'hurry up' tone during high traffic loading and in the case of faults.

A party: Prot_1
B party: Prot_1 or Prot_2A

The B party is active and answers.

The real time connection is connected between the parties. Neither of the parties has requested for a disconnection.



CON**R (1)
Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: 0
Conn. I.D. Y

CON**R (2)
Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z
Conn. I.D. Y

CONREA (3)
Sender: B-PARTY
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z
Conn. I.D. Y

DISCON (4)
Sender: MBX
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z
Conn. I.D. Y

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Date: 1990-02-23	Rev: A	File: MTS09B.2
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DISCON (5)

Sender: MBX
 Addressee: A-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

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A 292 51530

Cantel Mobitex-

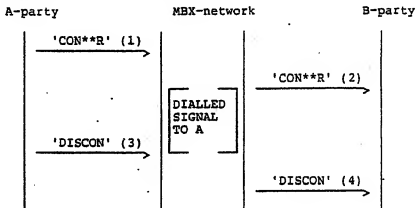
No. 52/1056 - A 296 5171/2 Ue
 Date: 1990-02-23 Rev. A P. 1.1
 MTS09B.2

8.5 B-party does not reply.

Dialogue 8.5.1

A party: Prot_1
 B party: Prot_1 or Prot_2A

B-party is active but does not generate HOOK-OFF.
 A-party generates HOOK-ON.



CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (3)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
 Addressee: B-PARTY
 Status: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

BitMark

Report

A 2921515-3

Cantel Mobitex

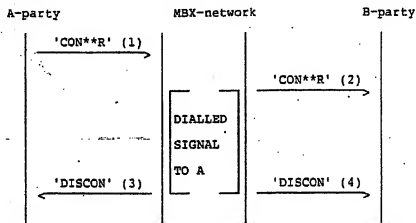
Doc No 52/1056 - A 296 5171/2 Ue
Docum Date 1990-02-23 / Rev A / P. No MTS09B.2

Dialogue 8.5.2

A party: Prot_1
B party: Prot_1 or Prot_2A

The B-party is active but does not reply.

The A party does not generate HOOK-ON (A party does not disconnect the call).



CON**R (1)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (3)

Sender: MBX
Addressee: A-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

DISCON (4)

Sender: MBX
Addressee: B-PARTY
Status: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

Bildschirm

Repro

A 29151330

Cantel Mobitex -

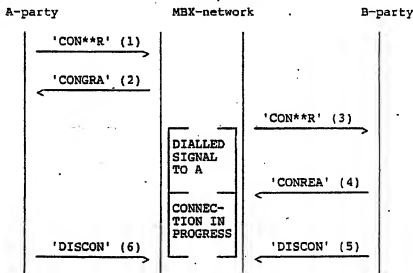
Doc No
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Doc Date
1990-02-23
Rev
A
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MTS09B.2

8.6 A-party with several line connections

Dialogue 8.6.1

A party: Prot_2A
B party: Prot_1 or Prot_2A

The B party is active and generates HOOK-OFF.



CON**R (1)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CONGRA (2)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: W
Conn. I.D. Y

CON**R (3)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: X
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

CONREA (4)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

Blanket

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Cantel Mobitex

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DISCON (5)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

DISCON (6)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: W
 Conn. I.D. Y

Bidder

Reprod

A 292 51330

Cantel Mobitex

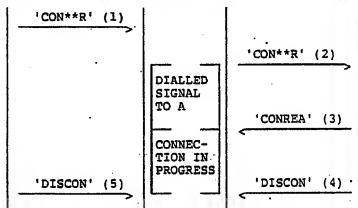
52/1056 - A 296 5171/2 Ue
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Dialogue 8.6.2

A party: Prot_2B
B party: Prot_1 or Prot_2A

The B party is active and generates HOOK-OFF.

A-party MBX-network B-party



CON**R (1)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: W
Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z
Conn. I.D. Y

CONREA (3)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z
Conn. I.D. Y

DISCON (4)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z
Conn. I.D. Y

8/10/00

Reprod

A 297 51332

Cantel Mobitex -

52/1056 - A 296 5171/2 Ue

1990-02-23 A MTS09B.2

DISCON (5)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: W
 Conn. I.D. Y

Bildkart

Regros

A 292 51532

Cantel Mobitex

No. 52/1056 - A 295 5171/2 Ue

Date: 1990-02-23 Rev. A PG. 1.1 MTS09B.2

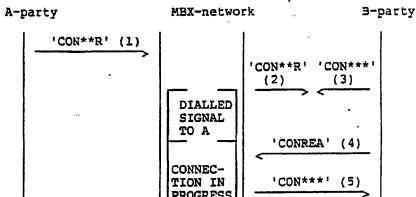
8.7 Conflicting connection requests.

Dialogue 8.7.1

A party: Prot_1
B party: Prot_1 or Prot_2A

B party has one free line

The B party is active and answers.



etc.

COMMENT : The network always has priority with calls to terminals Prot_1 and Prot_2A. In the case above, the network returns CON*** (3). With the aid of conn I.D., sender and addressee, the terminal must be able to see that order 5 does not apply to the current connection.

Note that the sequence of orders 4 and 5 can be reversed.

CON**R (1)
Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON**R (2)
Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

Block:

Repro:

Cantel Mobitex

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CON*** (3)

Sender: B-PARTY
Addressee: 'C-PARTY'
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. U

CONREA (4)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

CON*** (5)

Sender: B-PARTY
Addressee: 'C-PARTY'
Traf State: CONGEST
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. U

Subarea:

Region:

A 292 5153.3

Cantel Mobitex

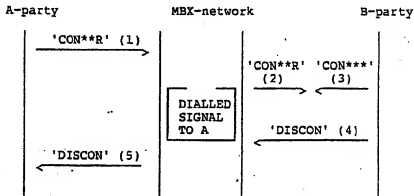
No. 52/1056 - A 296 5171/2 Ue
 Date 1990-02-23 Rev A P. 100 MTS09B.2

Dialogue 8.7.2

A party: Prot_1
 B party: Prot_2B

B party has one free line

The B party is active and answers.



COMMENT : Terminal Prot_2B has priority with calls to the network. In the case above, the terminal sends DISCON(4) as response to CON**R(2). Signal CON*** reach C-party.

CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: dont care=H
 Conn. I.D. Y

CON*** (3)

Sender: B-PARTY
 Addressee: 'C-PARTY'
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: N
 Conn. I.D. U

DISCON (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: H
 Conn. I.D. Y

Buildout

Report

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No. 52/1056 - A 296 5171/2 Ue

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DISCON (5)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: 0
Conn. I.D. Y

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A 292 211338

Cantel Mobitex

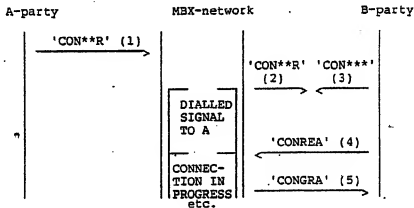
Doc No 52/1056 - A 296 5171/2 Ue
 Date: 1990-02-23 I Rev A Ps. P. MTS09B.2

Dialogue 8.7.3

A party: Prot_1
 B party: Prot_2A

B party has more than one line free for real time connection.

The B party is active and answers.



COMMENT : In the case above, the calls are treated independently of each other.

Note that the sequence of orders 4 and 5 can be reversed.

CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

CON*** (3)

Sender: B-PARTY
 Addressee: 'C-PARTY'
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. U

CONREA (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

StatSheet

Reprod

A 296 5153.3

Cantel Mobitex -	No. No		52/1056 - A 296 5171/2 Ue	
	Date		1990-02-23 A	
		F. No.		MTS09B.2
<p>CONGRA (5)</p> <p>Sender: 'C-PARTY'</p> <p>Addressee: B-PART</p> <p>Traf State: OK</p> <p>DIGITAL F: 0</p> <p>EXTERN F: 0</p> <p>Line nO.: V</p> <p>Conn. I.D. U</p>				
<p>Endert</p> <p>Reproe</p>				

A 10231503

Cantel Mobitex

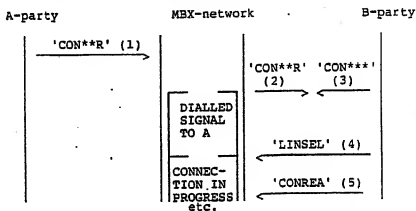
Doc No. 52/1056 - A 296 5171/2 Use
 Date Issued 1990-02-23 Lib A Ex No. MTS09B.2

Dialogue 8.7.4

A party: Prot_1
 B party: Prot_2B

B party has more than one line free for real time connection.

The B party is active and answers.



COMMENT : In the case above, the calls are treated independently of each other.

CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: dont care
 Conn. I.D. Y

CON*** (3)

Sender: B-PARTY
 Addressee: 'C-PARTY'
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: N
 Conn. I.D. U

LINSEL (4)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

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Start Date	1990-02-23	A
Pl. File	MTS09B.2	

CONREA (5)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

Bildart

Diagram

A 292 51535

Cantel Mobitex

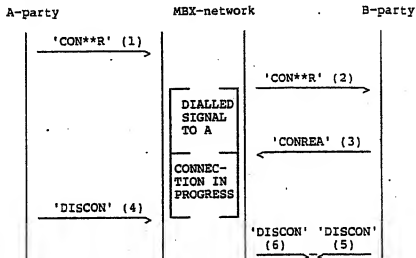
Doc No
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Docu Date 1990-02-23 A
File A
PC File
MTS09B.2

8.8 Conflicting disconnection orders.

Dialogue 8.8.1

A party: Prot_1
B party: Prot_1 or Prot_2A

The B-party is active and answers. The A-party and B-party both disconnect the real time connection but not at the same time.



COMMENT : After the B-party has sent DISCON (5), the B-party considers the connection is no longer in operation. Since the connection no longer exists when the B party accepts DISCON (6), this packet can be ignored.

CON**R (1)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

Bidder

Report

Cantel Mobitex -

52/1056 - A 296 5171/2 Ue

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Lib: A

File: MTS09B.2

CONREA (3)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

DISCON (6)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (5)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

Bildschirm

Keypress

A 296 51533

Cantel Mobitex

Doc No
52/1056 - A 296 5171/2 UeDate: Date
1990-02-23 AP. No
MTS09B.2

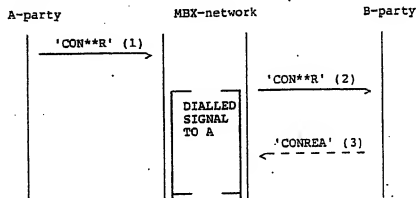
8.9 B-party's reply does not reach the network

Dialogue 8.9.1

A party: Prot_1

B party: Prot_1 or Prot_2A

The B-party is active but does not make contact with the network when the request has been received.



COMMENT : The CONREA packet does not reach the network, the B-party shall then consider that the CON**R signal has not been received.

CON**R (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. Y

CON**R (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

CONREA (3)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

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Reproe

A 292 51555

Cantel Mobitex

No. 52/1056 - A 296 5171/2 Ue
Date: Dec 1990-02-23 Rev A To: F. MTS09B.2

8.10 Connection request returned by the network

A returned request can be caused by :

- 1) B-party is not active
- 2) A-party lacks the service
- 3) technical error in the network
- 4) network is overloaded

etc.

Dialogue 8.10.1

A-party: Prot_1



COMMENT : If a terminal accepts CON*** with a traffic state that is not OK, this should be considered as a DISCON.

CON*** (1)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON*** (2)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: NO TRANSFER
or ILLEGAL
or CONGEST
or ERROR
or BUSY
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

Subkart

Reprod

A 296 51580

Cantel Mobitex

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Dialogue 8.10.2

A-party: Prot_2B

A-party MBX-network B-party

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      'CON***' (1)
      ────────────>
      'CON***' (2)
      <──────────
  
```

COMMENT : If a terminal accepts CON*** with a traffic state that is not OK, it should be considered as a DISCON.

CON*** (1)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: W
Conn. I.D. Y

CON*** (2)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: NO TRANSFER
 or ILLEGAL
 or CONGEST
 or ERROR
 or BUSY
DIGITAL F: 0
EXTERN F: 0
Line nO.: W
Conn. I.D. Y

Bulders

Reprod

A 296 5153/3

Cantel Mobitex

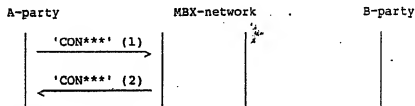
St. No. 52/1056 - A 296 5171/2 Ue
 Datum Date 1990-02-23 ID# A Pr. File MTS09B.2

Dialogue 8.10.3

A-party: Prot_2A

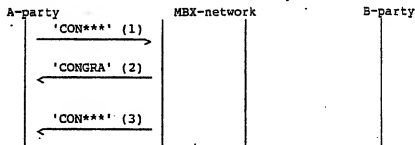
Two cases are possible:

Case 1:



COMMENT : If a terminal receives CON*** with a traffic state that is not OK, it should be considered as a DISCON.

Case 2:



COMMENT : If a terminal receives CON*** with a traffic state that is not OK, it should be considered as a DISCON.

CON*** (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D.: Y

CONGRA (2)

Sender: B-PARTY
 Addressee: A-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 line no.: W
 Conn. I.D.: Y

Diagrams:

Repro:

Cantel Mobitex-

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CON*** (3)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: NO TRANSFER
 or ILLEGAL
 or CONGEST
 or ERROR
 or BUSY
 DIGITAL F 0
 EXTERN F: 0
 Line no.: W
 Conn. I.D. Y

Bidcast

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A 292 11533

Cantel Mobitex

Doc No
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Serial Date
1990-02-23 A
Rev
P. No
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8.11 Non ordinary disconnect

This kind of disconnect is used when the network for some reason has lost the registration of connections.

Dialogue 8.11.1

A-party: Prot_1

B-party: Prot_1

A-party

MBX-network

B-party



DISCON (1) and (2)

Sender: MBX
Addressee: All terminal group man or
Fixed terminal man
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: 0
Conn. I.D. 0

COMMENT : Terminals shall always disconnect when receiving the DISCON.

Endort

Repro

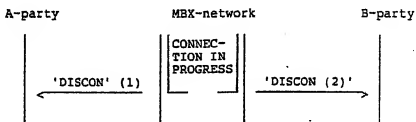
A 296 5171/2

Cantel Mobitex-

Mr. No.	52/1056 - A 296	5171/2 Ue
Document Date	1990-02-23	Rev. A
		P. No. MTS09B.2

Dialogue 8.11.2

A-party: Prot_2A or Prot_2B
B-party: Prot_2A or Prot_2B



DISCON (1) and (2)

Sender: MBX
Addressee: Fixed terminal man
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. 0

COMMENT : Terminals shall always disconnect when receiving this DISCON. Line number Z is in range 1 to N. N is maximum number of lines to this fixed terminal.

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Repro

A 292 5153-3

Cantel Mobitex -

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 Date: 1990-02-23 Rev: A File: MTS09B.2

8.12 Request for non ordinary disconnect.

This kind of disconnect is used when the terminal has lost the registration of connections.

Valid for fixed terminal Prot_2A or Prot_2B.

Fixed term MBX-network

'DISCON' (1)
 'DISCON' (2)
 'DISCON' (3)
 .
 'DISCON' (N)
 'DISCON' (N+1)

DISCON (1)

Sender: Fixed term
 Addressee: MBX
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 0
 Conn. I.D. 0

DISCON (2)

Sender: MBX
 Addressee: Fixed term
 Traf state: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 1
 Conn. I.D. 0

DISCON (3)

Sender: MBX
 Addressee: Fixed term
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: 2
 Conn. I.D. 0

DISCON (N)

Sender: MBX
 Addressee: Fixed term
 Traf state: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: N-1
 Conn. I.D. 0

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Cantel Mobitex-

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DISCON (N+1)

Sender: MBX
 Addressee: Fixed term
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: N
 Conn. I.D. 0

COMMENT : Terminals shall always disconnect when receiving this DISCON. N is maximum number of lines to this fixed terminal. Only fixed terminals with more than one line may send DISCON(1).

Bildschirm

Reprod

A 297 5153

Cantel Mobitex

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8.13 Request for connection to unknown B-party

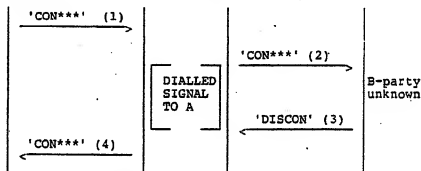
The addressee in CON*** is unknown in the terminal, e.g. personal subscription has just logged out.

Instead of a CONREA or a returned CON***, the terminal should send a DISCON with the subscriber flag UNKNOWN_F=1.

A-party

MBX-network

B-terminal



COMMENT : The connection identity which the A-party selects for CON*** (1) shall be included in all orders processed by the relevant connection. Orders 2-4 in this case.

CON*** (1)

Sender: : A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

CON*** (2)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (3)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
UNKNOWN_F: 1
Line no.: Z
Conn. I.D. Y

CON*** (4)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: NO_TRANSFER
DIGITAL F: 0
EXTERN F: 0
UNKNOWN_F: 0
Line no.: 0
Conn. I.D. Y

Subscript

Repeat

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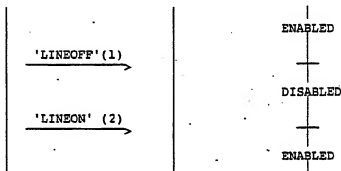
8.14 Enable / disable lines for fixed terminals

This kind of enable and disable is used when a fixed terminal, for some reason, does not want the network to connect on a special line.

Fixed terminal Prot_2A.

Case 1:

Fixed terminal MBX-network status of line Z



LINEOFF (1)

Sender: Fixed terminal
Addressee: MBX
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z

LINEON (2)

Sender: Fixed terminal
Addressee: MBX
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line nO.: Z

NOTE : The network may send packets CSUBCOM.CLOOPON and CSUBCOM.CLOOPOFF during the time in disabled mode. See Appendix B-11.

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Case 2:

Fixed terminal MBX-network status of line Z

'LINEOFF' (1)

'DISCON' (2)

ENABLED

DISABLED

ENABLED

LINEOFF (1)

Sender: Fixed terminal
Addressee: MBX
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z

DISCON (2)

Sender: MBX
Addressee: Fixed terminal
Traf state: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. 0

COMMENT : DISCON(2) is of type "Non ordinary disconnect".
If the fixed terminal wants the network to
disable the line after receiving DISCON(2), it
has to send LINEOFF(1) again.

Diagrams

Report

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 Datum: 1990-02-23 A
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9 EXTERNAL CONNECTION

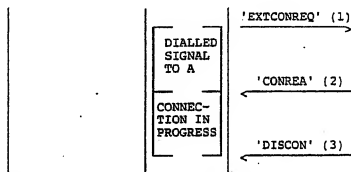
9.1 From circuit switched network

B party is active and replies.

A party in another network

MBX-network

B-party



COMMENTS : The procedure is completely identical to a ordinary connection. The only difference is that EXTCONREQ is used instead of CON**R.

EXTCONREQ (1)

Sender: EXT NET
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 1
 Line no.: Z
 Conn. I.D. Y

CONREA (2)

Sender: B-PARTY
 Addressee: EXT NET
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

Ext.sub.no: A-party's number in external network, if known

DISCON (3)

Sender: B-PARTY
 Addressee: EXT NET
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line no.: Z
 Conn. I.D. Y

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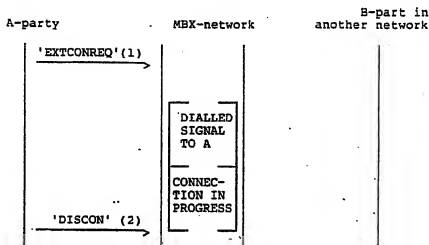
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9.2 To circuit switched network



COMMENT : The procedure is completely identical to a ordinary connection. The only difference is that EXTCONREQ is used instead of CON**R.

EXTCONREQ (1)	DISCON (2)
SENDER: A-PARTY	Sender: A-PARTY
Addressee: EXT NET	Addressee: EXT NET
Traf State: OK	Traf State: OK
DIGITAL F: 0	DIGITAL F: 0
EXTERN F: 1	EXTERN F: 0
Line no.: 0	Line no.: 0
Conn. I.D. Y	Conn. I.D. Y

Ext.sub.no: B-party's number
in external network

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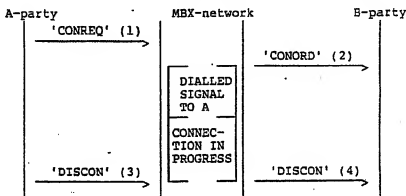
A 292 51533

Cantel Mobitex

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10 CONNECTION TO GROUP

10.1 Ordinary circuit switched connection to group



COMMENT : If the B-party accepts CONORD, CONREQ shall not be sent. Neither may the B-party send DISCON on a connection that has been generated with CONORD.

If there is no HOOK-OFF within 60 seconds after the reception of CONORD or if the B-party generates HOOK-ON during the connection, the B-party terminal shall return to the system channel without sending DISCON. More details of this are given in the link layer for mobile terminals.

We do strongly recommend that, after reception of a CONORD, the terminal turns the loudspeaker on.

CONREQ (1)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: 0
 Conn. I.D. Y

CONORD (2)

Sender: A-PARTY
 Addressee: B-PARTY
 Traf State: OK
 DIGITAL F: 0
 EXTERN F: 0
 Line nO.: Z
 Conn. I.D. Y

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DISCON (3)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

DISCON (4)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

NOTE 1 : If a fixed terminal is B-party in a group a normal CONREQ is used to the fixed terminal.

NOTE 2 : CONORD(2) is repeated continuously and may therefore appear also during the connection. CONORD(2) is repeated to give terminals the possibility to connect to the group connection after the group connection was made. This can be used if the terminal was busy when the group connection was made.

NOTE 3: CONREQ(1) can also be MPAK CONFAST.

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Reprod

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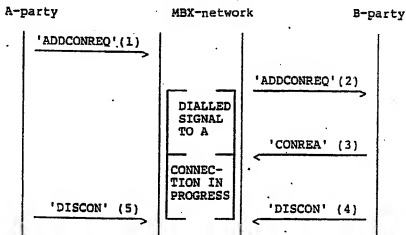
No. 52/1056 - A 296	5171/2 Ue
Service Date 1990-02-23	Rev. A
	File No. MTS09B.2

11 ADDITIONAL CONNECTION

11.1 Ordinary additional connection

The A-party has one line for real time connection. The B party has one or more lines for real time connection.

The B party is active and replies.



COMMENT : The procedure is identical to a ordinary connection. The only difference is that additional information 'S' follows the connection.

ADDCONREQ (1)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y
Add. info: OPTIONAL=S

ADDCONREQ (2)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y
Add. info: S

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CONREA (3)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (4)

Sender: B-PARTY
Addressee: A-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: Z
Conn. I.D. Y

DISCON (5)

Sender: A-PARTY
Addressee: B-PARTY
Traf State: OK
DIGITAL F: 0
EXTERN F: 0
Line no.: 0
Conn. I.D. Y

Buildout

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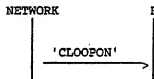
1990-02-23 A MTS09B.2

12 LINE TEST

The network generates 'CLOOPON' and 'CLOOPOFF' according to the criteria and with the structure given in Appendix A.

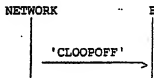
Dialogue 12.1:

Start of loop test.



Dialogue 12.2:

End of loop test.



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Diagram

A 292 51533

Cantel Mobitex -

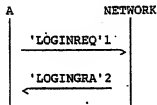
No. 52/1056 - A 296 5171/2 Ue
 Date 1990-02-23 Rev A File MTS09B.2

13 LOGIN

The factor common to all dialogues for log-in is that the original packet ('LOGINREQ') is generated by the A-party according to the criteria and with the structure stated in Appendix A. Reservation is stated for the respective dialogue.

Dialogue 13.1:

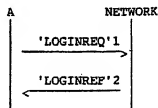
Login granted.



The network generates 'LOGINGRA' according to the criteria and with the structure stated in Appendix A.

Dialogue 13.2:

Login refused by the network.



The network generates 'LOGINREF' according to the criteria and with the structure stated in Appendix A.

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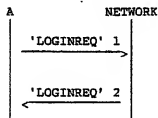
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Dialogue 13.3:

Login has not taken place.



- a) Log-in may not take place. Incorrect subscription number may have been given.

'LOGINREQ' 2 is returned with traffic state = ILLEGAL

- b) The network is overloaded.

'LOGINREQ' 2 is returned with traffic state = CONGEST

- c) A technical fault may have occurred.

'LOGINREQ' 2 is returned with traffic state = ERROR

Blockers:

Reques

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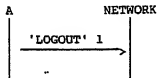
Doc No
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Doc Date
1990-02-23 A
P. No
MTS09B.2

14 LOGOUT

The A-party generates 'LOGOUT' according to the criteria and with the structure stated in Appendix A.

Dialogue 14.1:

Subscription initiates log-out.

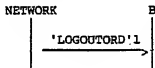


Dialogue 14.2:

Network initiates logout.

The subscription has sent a LOGINREQ from a terminal but is still registered as logged-in to another terminal. The network will then send LOGOUTORD to the old terminal according to the criteria and with the format stated in Appendix A.

The personal subscription should immediately be deleted from the B-party's flexlist.



If the network has sent a LOGOUTORD and the old terminal did not receive it, the LOGOUTORD is repeated when the subscriber sends a message next time.

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A 292 5153-3

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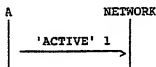
Mr. No.	52/1056 - A 296 5171/2 Ue
Contract Date	1990-02-23 A
P. P. A.	MTS09B.2

15 ACTIVATION

The A-party generates 'ACTIVE' according to the criteria and with the format stated in Appendix A.

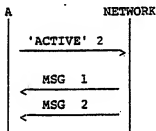
Dialogue 15.1:

Activation is approved and the mailbox is empty.



Dialogue 15.2:

Activation is approved and there are packets in the mailbox, both for the terminal and the personal subscription.



MSG 1 and 2 are packets (MPAK) that has been stored in the network mailbox while the terminal has been inactive. Each packet sent out from the mailbox is delayed a certain time in order not to overload the terminal.

Blockers

Regres

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Cantel Mobitex

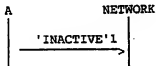
Doc No
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Doc No
1990-02-23 A
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MTS09B.2

16 INACTIVATION

The A party generates 'INACTIVE' according to the criteria and with the format stated in Appendix A.

Dialogue 16.1:

Inactivation.



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 Date: 1990-02-23 Rev: A File: MTS09B.2

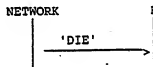
17 DIE - LIVE

The network generates 'DIE' and 'LIVE' according to the criteria and with the format stated in Appendix A.

when the terminal receives 'DIE' it is not allowed to send any user traffic to the network, until a 'LIVE' has been received. User traffic is defined as packets included in the packet classes; PSUBCOM, PSOSCOM and CSUBCOM. The terminal may send DTESERV packets.

Dialogue 17.1:

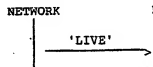
The terminal may not send user traffic.



'DIE' is stored in the network mailbox if the B-party is not active. The packet is sent out according to Dialogue 15.2 when the B party is active again.

Dialogue 17.2 :

The terminal may send packets again.



'LIVE' is stored in the network mailbox if the B-party is not active. The packet is sent out according to dialogue 15.2 when the B-party is active again.

Diagrams

Diagram

Cantel Mobitex

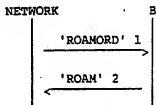
Doc No 52/1056 - A 296 5171/2 Ue
 Creation Date 1990-02-23 A Rev 1
 File MTS09B.2

18 ROAMING

Dialogue 18.1:

The network requests the terminal to send a ROAM packet.

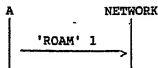
The network generates 'ROAMORD' according to the criteria and with the format stated in Appendix A.



The B-party generates 'ROAM' 2 according to the criteria and with the format stated in Appendix A.

Dialogue 18.2:

The A-party generates 'ROAM' spontaneously according to the criteria and with the format stated in Appendix A. A spontaneous generation of a ROAM packet is initiated from the roaming procedure described in the mobile terminal data link layer.



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No. 52/1056 - A 296 5171/2 Ue						
<table border="1"> <tr> <td>Drawn Date</td> <td>Rev</td> <td>File No.</td> </tr> <tr> <td>1990-02-23</td> <td>A</td> <td>MTS09B.2</td> </tr> </table>	Drawn Date	Rev	File No.	1990-02-23	A	MTS09B.2
Drawn Date	Rev	File No.				
1990-02-23	A	MTS09B.2				

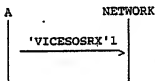
19 RE-DIRECTION OF EMERGENCY MESSAGES

This is used when the emergency messages should be sent to the alternative emergency receiver.

The A party generates 'VICESOSRX' according to the criteria and with the format stated in Appendix A.

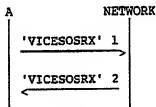
Dialogue 19.1:

The re-direction is approved.



Dialogue 19.2:

The 'VICESOSRX' is returned from the network.



a) Re-direction cannot/may not take place.

'VICESOSRX' 2 is returned with traffic state =ILLEGAL

b) The network is overloaded.

'VICESOSRX' 2 is returned with traffic state = CONGEST

c) A technical fault may have occurred.

'VICESOSRX' 2 is returned with traffic state = ERROR

Editors

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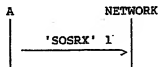
Cantel Mobitex-

Doc. No.	52/1056 - A 296 5171/2 Ue
Issue Date	1990-02-23
Rev	A
File No.	MTS09B.2

20 CANCEL RE-DIRECTION OF EMERGENCY MESSAGES

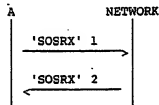
Dialogue 20.1:

The re-direction is cancelled.



Dialogue 20.2:

The cancellation of the re-direction cannot/may not be accepted.



'SOSRX' 2 is returned with traffic state = ILLEGAL

Bidirectional

Revised

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Заключение

DATE - DAY 1990-02-23 Rev A

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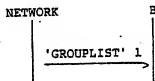
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21 UPDATING GROUPLIST

Dialogue 21.1:

The network generates 'GROUPLIST' according to the criteria and with the format stated in Appendix A.



'GROUPLIST' is stored in the network mailbox if the B party is not active. The packets are sent out according to dialogue 15.2 when the B party is active again.

Bekänt

Παραπομπή

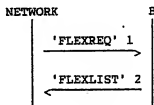
Cantel Mobitex

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Issue Date 1990-02-23 Rev. A File No. MTS09B.2

22 UPDATING THE LIST OF PERSONAL SUBSCRIPTIONS

Dialogue 22.1:

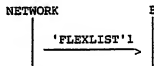
The network generates 'FLEXREQ' according to the criteria and with the format stated in Appendix A.



'FLEXLIST' is generated according to the criteria and with the format stated in Appendix A.

Dialogue 22.2:

The network generates 'FLEXLIST' according to the criteria and with the format stated in Appendix A.



'FLEXLIST' is stored in mailbox if the B party is not active. The packet is sent out according to dialogue 15.2 when the B party is active again.

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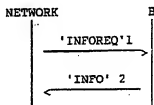
Cantel Mobitex -

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23 TECHNICAL INFORMATION

Dialogue 23.1:

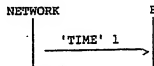
The network generates 'INFOREQ' according to the criteria and with the format stated in Appendix A.



24 TIME INFORMATION

Dialogue 24.1:

The network generates 'TIME' according to the criteria and with the format stated in Appendix A.



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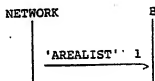
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 Edition Date 1990-02-23 Rev A FC-PM MTS09B.2

25 UPDATING AREALIST

Dialogue 25.1:

The network generates 'AREALIST' according to the criteria and with the format stated in Appendix A.

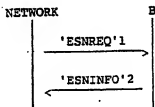


'AREALIST' is stored in the network mailbox if the B party is not active. The packets are sent out according to dialogue 15.2 when the B party is active again.

26 ELECTRONIC SERIAL NUMBER CHECK

Dialogue 26.1:

The network generates 'ESNREQ' according to the criteria and with the format stated in Appendix A.



Bildtext

Legend

Produkt-Produkt ET/SYS PES	Produkt-Produkt-Produkt ET/SYS PES	St. Nr. 53/1056-A 296 5171/2 Ue	
Produkt-Produkt-Produkt ET/SYSC STT <i>ST</i>		Datum 1990-02-23	Rev. A
Bezeichnung Cantel Mobitex -		Titel MOBITEX Network layer for terminals Appendix C. Logical description	
<p><u>ABSTRACT</u></p> <p>This document contains the logical description for the network layer for <u>mobile terminals</u> connected to the MOBITEX system.</p>			

Bildschirm

Reprint

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Date: 1990-02-23 Rev: A P. 1 of 2
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Blockset

Diagram

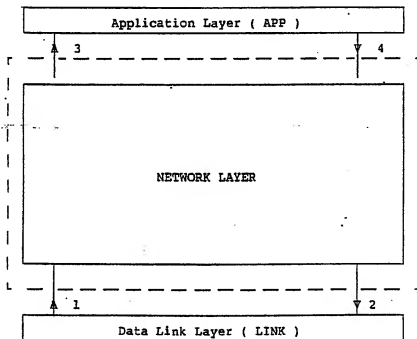
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Doc. No. 53/1056-A 296 5171/2 Ue
 Version Date 1990-02-23 1 Rev. A File No. MTS09C.2

1 GENERAL

1.1 DATA FLOW DIAGRAM

The data flow diagram below shows the interaction between the network layer and the other two layers; the data link layer and the application layer.



Signals to/from Data Link Layer.

- 1- MPAK transmitted, MPAK_not_transmitted, MPAK_received, roaming, activation
- 2- MPAK to transmit, MPAK to retransmit, speech_on, speech_off, order to return_MPAK, group_list_information, area_list_information

Signals to/from Application Layer.

- 3- MPAK_received, returned_MPAK_with_code, die, live, buffer_full
- 4- MPAK_to_transmit, hook_on, hook_off, power_off, manual_mode_on, MPAK_to_retransmit

Editor
 Reviewer
 Approver

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		Rev A
		File No MTS09C.2
1.2 TERMINOLOGY		
P_ / F_	In this logical description, all procedures starts with "P_", and all functions with "F_".	
input_signal	The network layer has an input queue. A signal from this input queue is called "input_signal".	
wait_for_input_signal	The network layer is waiting until an input_signal is available.	
save_signal	Restoring the signal into the queue. This is done when you expect a certain signal. By repeating input_signal and save_signal, you can search in the input queue for certain signals. All saved signals are available when an input_signal follows after an input_signal without any save_signal between. See chapter 'Queue handling'.	
ignore_signal	No further handling of this signal, except that the signal should be deleted.	
groupulist	Area where group MAN are stored. This list should be stored also during power off.	
flexlist	Area where personal subscription MAN are stored. This list should be stored also during power off.	
permanent_list	Total area to be continuously stored. In this area terminal MAN, serial number, group list, flexlist, die_state and live state are stored. The checksum is calculated based on this list.	
groupulist_received_flag	Indication of a correct permanent list and that a MPAR:GROUPLIST is received or not.	
active_delay_power_up	Activation delay concerning power-up and manual radio mode. See RI-06.	
active_delay_lost_contact	Activation delay concerning lost contact. See RI-06.	
power_off_ready	Flag to indicate that the network layer is ready to be closed.	

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manual_mode

Flag to indicate that the mobile station is in manual mode.

buffer_full_flag

Indication of buffer full.

emergency_flag

Indication of an activated emergency. When application layer receive an emergency signal, this flag is raised. Now the network layer can handle the priority of emergency in the terminal.

Buildout

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<p>1.2 SIGNALS</p> <p>MPAK_to_transmit MPAK received from the application layer or MPAK to the data link layer to be transmitted.</p> <p>MPAK_received MPAK received by the data link layer or MPAK to be sent to the application layer.</p> <p>MPAK_transmitted MPAK successfully transmitted by the data link layer.</p> <p>MPAK_not_transmitted MPAK not transmitted by the data link layer.</p> <p>MPAK_to_retransmit MPAK from the application layer to the data link layer to be retransmitted (special treatment in the data link layer).</p> <p>roaming Order to the network layer to send an MPAK:ROAM.</p> <p>activation Start activation timeout (after power-on or lost contact with base) given in R1-06.</p> <p>speech_on Order to the data link layer to set mode speech_on.</p> <p>speech_off Order to the data link layer to set mode speech_off.</p> <p>order_to_return_MPAK Order to the data link layer to stop sending an MPAK, and return the MPAK to the network layer.</p> <p>group_list_information Group list information to the data link layer.</p> <p>area_list_information Area list information to the data link layer.</p> <p>returned_MPAK_with_code Returned MPAK with code information from the network layer. The code shows why the MPAK was returned.</p>			
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hook_on	Hook on signal from the application layer.
hook_off	Hook off signal from the application layer.
die	A signal informing that the network layer has received an MPAK:DIE. All user traffic is stopped and returned to the application layer.
live	A signal informing that the network layer has received an MPAK:LIVE. User traffic from the application layer can be handled.
buffer_full	Queue for incoming messages is full. Incoming and outgoing traffic from/to the MOBITEK network is stopped. The network layer tries to send MPAK:INACTIVE. Application layer is informed. When the message buffer has space for at least 6 messages, according to specification R1-09, the buffer_full_flag is reset and incoming and outgoing traffic is resumed.
power_off	The application layer wants to turn the network layer off. The network layer tries to send an MPAK:INACTIVE.
power_off_timeout	Internal timeout to indicate that the network layer is ready to be turned off.
manual_mode_on	The application layer wants to turn over to manual radio mode. The network layer tries to send an MPAK:INACTIVE.
manual_mode_on_timeout	Internal timeout to indicate that the network layer is ready to turn over to manual radio mode.

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1.3 RETURNED MPAK WITH CODE

CODE	MEANING
SENT	This MPAK has been correctly sent by the data link layer.
NOT_SENT	This MPAK has not been correctly sent by the data link layer.
NOT_SENT_SPEECH	This MPAK has not been sent because of speech state in the network layer.
NOT_SENT_DIE	This MPAK has not been sent because of die state in the network layer.
NOT_SENT_BUFFER_FULL	This MPAK has not been sent because of buffer_full state in the network layer.
INCORRECT	Received MPAK from the application layer, do not have a correct format or is not allowed to be sent.
PERSONAL_MAN_EXIST	Present personal subscription MAN already exist in the flexlist.
PERSONAL_MAN_NOT_EXIST	Present personal subscription MAN does not exist in the flexlist.
FLEXLIST_FULL	The maximum number of MAN in the flexlist is exceeded.

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1.4 STATES

idle	Idle state
die_state	A received MPAK:DIE has ordered the mobile to this state. No outgoing user traffic is allowed. A received MPAK:LIVE orders the mobile to idle state.
sending_during_die	Only MPAK of class DTESERV and MPAK:DISCON (CSUBCOM) can be sent during die_state.
link_busy	The data link layer can only handle one packet at a time. In the present state, the data link layer is busy.
sending_conreq	The data link layer is busy sending speech request.
stop_sending	The network layer has ordered the data link layer to stop sending present packet. The network layer is waiting until the data link layer is ready.
wait_for_hook_off_normal	A normal speech request is received and the network layer is waiting for response from the application layer.
wait_for_hook_off_fast	A fast speech request is received and the network layer is waiting for response from the application layer.
wait_for_hook_off_group	A group speech request is received and the network layer is waiting for response from the application layer.
sending_conrea	The data link layer is busy sending a hook_off signal (MPAK:CONREA).
speech_normal	The network layer is in speech state.
speech_group	The network layer is in group speech state.
sending_discon	The data link layer is busy sending a hook_on signal(MPAK:DISCON).

Buildout

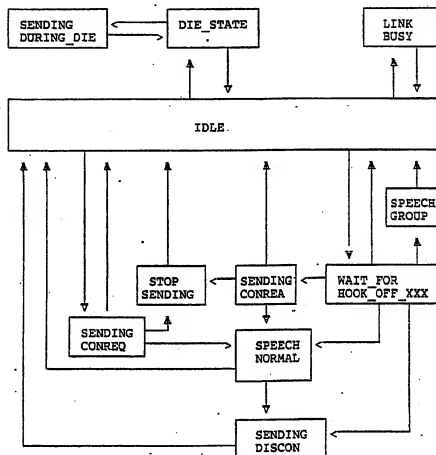
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1.5 STATE DIAGRAM



WAIT_FOR HOOK OFF XXX can be in three different states depending on the received speech request, as follows:

STATE

WAIT_FOR_HOOK_OFF_NORMAL

WAIT_FOR_HOOK_OFF_FAST

WAIT_FOR_HOOK_OFF_GROUP

WHEN RECEIVING

CONREQ, ADDCONREQ, SOSCONREQ or EXTCONREQ

CONFAST, ADDCONFAST or SOSCONFAST

CONORD

Address

Mapros

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1.6 QUEUE HANDLING

input queue:

2

1

<----- input_queue_pointer

Input_signal:

3

2

1

<----- input_queue_pointer+1

-----> signal available for user

Save_signal:

3

2

1

<----- input_queue_pointer+1

<----- save_input_queue_pointer

Input_signal and save_signal:

3

2

1

<----- input_queue_pointer+2

<----- save_input_queue_pointer+1

<----- save_input_queue_pointer

Input_signal :

4

3

2

1

<----- input_queue_pointer+3

-----> signal available for user

<----- save_input_queue_pointer+1

<----- save_input_queue_pointer

Input_signal :

4

2

1

<----- input_queue_pointer+1

-----> signal available for user

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2 LOGICAL DESCRIPTION

2.1 Start of program

This program have two different modes, MOBITEX mode and MANUAL mode. In MANUAL mode, the network layer is stopped. When MOBITEX mode is activated from MANUAL mode the network layer should be restarted.

NETWORK LAYER

```
P_activation_handling
next_state = idle
emergency_flag = FALSE
IF permanent_list is not correct THEN
  make MPAK BORN
  send MPAK_to_transmit to LINK
  next_state = link_busy
  reset grouplist and flexlist
  set NOT_grouplist_received_flag
ENDIF
LOOP
  IF manual_mode THEN
    MOBITEX_network_layer_inactivated
    activated = FALSE
    handle_manual_mode
  ELSE
    wait_for_input_signal
    IF emergency_flag THEN
      P_look_for_emergency
    ENDIF
    CASE signal
      WHEN MPAK_to_transmit from APP
        P_MPAK_FROM_APP
      WHEN MPAK_to_retransmit from APP
        P_MPAK_TO_RETRANSMIT
      WHEN MPAK_received from LINK
        P_REC_MPAK_FROM_LINK
      WHEN MPAK_transmitted from LINK
        P_MPAK_TRANSMITTED
      WHEN MPAK_not_transmitted from LINK
        P_MPAK_NOT_TRANSMITTED
      WHEN hook_on from APP
        P_HOOK_ON_handling
      WHEN hook_off from APP
        P_HOOK_OFF_handling
      WHEN hook_off_timeout
```

Blocker:

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```

P_timeout_handling
  WHEN roaming from LINK
    P_roaming_handling
  WHEN activation from LINK
    P_activation_handling_link
  WHEN activation_timeout
    P_activation_timeout_handling
  WHEN power_off from APP
    P_power_off_handling
  WHEN manual_mode_on
    P_manual_mode_on_handling
  WHEN power_off_timeout
    set power_off_ready
  WHEN manual_mode_on_timeout
    set manual_mode
  WHEN buffer_full
    P_buffer_full_handling
  ENDCASE
ENDIF
ENDLOOP
END_NETWORK_LAYER

```

Blockout

Repeat

<h2 style="margin: 0;">Cantel Mobitex</h2>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">St. No.</td> <td style="padding: 2px;">53/1056-A 296 5171/2 Ue</td> </tr> <tr> <td style="padding: 2px;">Datum / Jare</td> <td style="padding: 2px;">1990-02-23 A</td> </tr> <tr> <td style="padding: 2px;">F. v. e</td> <td style="padding: 2px;">MTS09C.2</td> </tr> </table>	St. No.	53/1056-A 296 5171/2 Ue	Datum / Jare	1990-02-23 A	F. v. e	MTS09C.2
St. No.	53/1056-A 296 5171/2 Ue						
Datum / Jare	1990-02-23 A						
F. v. e	MTS09C.2						

```

2.1.1  P_LOOK_FOR_EMERGENCY
P_look_for_emergency
    emergency_signal = FALSE
    WHILE NOT emergency_signal THEN
        CASE MPAK.type
            WHEN SOS,SOSINFO,SOSACK,SOSCONREQ,SOSCONFAST
                emergency_signal = TRUE
            WHEN OTHERWISE
                save_signal
                input_signal
        ENDCASE
    ENDWHILE
END_P_look_for_emergency

```

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Date: 1990-02-23 Iss: A Ver: WTS09C.2

2.2 P_MPAK_FROM_APP

```

P_MPAK_FROM_APP
IF NOT buffer_full_flag THEN
CASE next_state
    WHEN idle
        CASE MPAK.class
            WHEN PSUBCOM,PSOSCOM
                P_check_format
                IF format = true THEN
                    send MPAK to transmit to LINK
                    next_state = LINK_BUSY
                ELSE
                    send returned_MPAK_with_code:INCORRECT to APP
                ENDIF
            WHEN CSUBCOM
                P_check_format
                IF format = true THEN
                    P_check_and_send_CSUBCOM
                ELSE
                    send returned_MPAK_with_code:INCORRECT to APP
                ENDIF
            WHEN DTESERV
                P_check_format
                IF format = true THEN
                    P_check_and_send_DTESERV
                ELSE
                    send returned_MPAK_with_code:INCORRECT to APP
                ENDIF
        ENDCASE
    WHEN die_state
        IF MPAK.class = DTESERV THEN
            P_check_format
            IF format = true THEN
                P_check_and_send_DTESERV
            ELSE
                send returned_MPAK_with_code:INCORRECT to APP
            ENDIF
        ELSE
            send returned_MPAK_with_code:NOT_SENT_DIE
        ENDIF
    WHEN
        wait_for_hook_off_normal,
        wait_for_hook_off_fast,
        wait_for_hook_off_group
        IF MPAK.class = CSUBCOM THEN
            P_check_format
            IF format = true THEN
                CASE MPAK.type
                    WHEN CONREA
                        P_hook_off_handling
                    WHEN DISCON
                        P_hook_on_handling
                    WHEN OTHERWISE

```

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```

      send returned_MPAK_with_code:NOT_SENT_SPEECH
    ENDCASE
  ELSE
    send returned_MPAK_with_code:INCORRECT to APP
  ENDIF
ELSE
  IF MPAK.class = PSOSCOM THEN
    save signal
    make hook on signal
    P HOOK_ON_handling
  ELSE
    send returned_MPAK_with_code:NOT_SENT_SPEECH to APP
  ENDIF
ENDIF
WHEN sending_conreq,sending_conrea,speech_normal,speech_group
IF MPAK.class = CSUBCOM THEN
  P check_format
  IF format = true THEN
    CASE MPAK.type
      WHEN DISCON
        P hook on handling
      WHEN OTHERWISE
        send returned_MPAK_with_code:NOT_SENT_SPEECH
    ENDCASE
  ELSE
    send returned_MPAK_with_code:INCORRECT to APP
  ENDIF
ELSE
  IF MPAK.class = PSOSCOM THEN
    CASE next_state
      WHEN sending_conreq,sending_conrea
        save signal
        send order to return MPAK to LINK
        next_state = stop_sending
      WHEN speech_normal,speech_group
        save signal
        make hook on signal
        P HOOK_ON_handling
    ENDCASE
  ELSE
    send returned_MPAK_with_code:NOT_SENT_SPEECH
  ENDIF
ENDIF
WHEN OTHERWISE
  save signal
ENDCASE
ELSE
  CASE MPAK.class
    WHEN PSUBCOM,PSOSCOM
      P check_format
      IF format = true THEN
        send MPAK to transmit to LINK
        next_state = LINK_BUSY
      ELSE
        send returned_MPAK_with_code:INCORRECT to APP
      ENDIF
    ELSE

```

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```

WHEN OTHERWISE
    send returned_MPAK_with_code:NOT_SENT_BUFFER_FULL
ENDCASE
ENDIF
END_P_MPAK_FROM_APP
    
```

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		1990-02-23	MTS09C.2
<p>2.2.1 F_CHECK_FORMAT</p> <p>F_check_format</p> <p>This routine checks and completes the format of this MPAK to be correct according to R1-09 Appendix A. A correct MPAK will be returned with format = TRUE. An incorrect MPAK will be returned with format = FALSE.</p> <p>END_F_check_format</p> <p>2.2.2 P_CHECK_AND_SEND_DTESERV</p> <p>P_check and send_DTESERV</p> <pre> CASE MPAK.type WHEN LOGINREQ IF MPAK.type_dependent in our flexlist THEN send returned_MPAK_with_code:PERSONAL_MAN_EXIST to APP ELSE IF more space in our flexlist MPAK.sender = MCU MAN send MPAK_to_transmit to LINK next_state = LINK_BUSY ELSE send returned_MPAK_with_code:FLEXLIST_FULL ENDIF ENDIF WHEN VICESOSRX,SOSRX IF MPAK.sender in our flexlist THEN send MPAK_to_transmit to LINK next_state = LINK_BUSY ELSE send returned_MPAK_with_code:PERSONAL_MAN_NOT_EXIST to APP ENDIF WHEN LOGOUT remove MPAK.sender from our flexlist MPAK.type_dependent = MCU MAN send MPAK_to_transmit to LINK next_state = LINK_BUSY WHEN ACTIVE,INACTIVE send MPAK_to_transmit to LINK next_state = LINK_BUSY WHEN OTHERWISE send returned_MPAK_with_code:INCORRECT to APP ENDCASE END_P_check_and_send_DTESERV </pre>			

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2.2.3 P_CHECK_AND_SEND_CSUBCOM

P_check_and_send_CSUBCOM

```

_CASE MPAK.type
  WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ,
    CONFAST,ADDCONFAST,SOSCONFAST
    MPAK.line = 0
    MPAK.connection_identity = next MPAK.connection_identity
    SPEECH_REG.part_here = MPAK.sender
    SPEECH_REG.other_part = MPAK.addressee
    SPEECH_REG.line = MPAK.line
    SPEECH_REG.conn_id = MPAK.connection_identity
    send MPAK_to_transmit to LINK
    next_state = sending_conreq

  WHEN DISCON
    send MPAK DISCON with
      MPAK.sender = SPEECH_REG.part_here
      MPAK.addressee = SPEECH_REG.other_part
      MPAK.line = SPEECH_REG.line
      MPAK.connection_identity = SPEECH_REG.conn_id
    send MPAK_to_transmit to LINK
    next_state = sending_discon

  WHEN OTHERWISE
    ignore_signal

ENDCASE
END_P_check_and_send_CSUBCOM

```

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 1990-02-23 A MTS09C.2

2.3 P_MPAK_TO_RETRANSMIT

P_MPAK_to_retransmit

```

CASE next_state
WHEN idle
  CASE MPAK.class
  WHEN PSUBCOM,PSOSCOM
    P check format
    IF format = true THEN
      send MPAK_to_retransmit to LINK
      next_state = LINK_BUSY
    ELSE
      send returned_MPAK_with_code:INCORRECT to APP
    ENDIF
  WHEN OTHERWISE
    send returned_MPAK_with_code:INCORRECT to APP
  ENDCASE
WHEN die_state
  send returned_MPAK_with_code:NOT_SENT_DIE
WHEN
  wait_for_hook_off normal,
  wait_for_hook_off fast,
  wait_for_hook_off group
  IF MPAK.class = PSOSCOM THEN
    save_signal
    make hook on signal
    P HOOK_ON_handling
  ELSE
    send returned_MPAK_with_code:NOT_SENT_SPEECH to APP
  ENDIF
WHEN sending_conreq,sending_conrea,speech_normal,speech_group
  IF MPAK.class = PSOSCOM THEN
    CASE next_state
    WHEN sending_conreq,sending_conrea
      save_signal
      send order_to_return_MPAK to LINK
      next_state = stop_sending
    WHEN speech_normal,speech_group
      save_signal
      make hook on signal
      P HOOK_ON_handling
    ENDCASE
  ELSE
    send returned_MPAK_with_code:NOT_SENT_SPEECH
  ENDIF
WHEN OTHERWISE
  save_signal
ENDCASE
END P_MPAK_to_retransmit

```

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1990-02-23 A MTS09C.2

2.4 P_REC_MPAK_FROM_LINK

P_REC_MPAK_FROM_LINK

```

activated = TRUE
CASE MPAK.class
WHEN PSUBCOM,PSOSCOM
  IF F.get rec man = MCU MAN or in flexlist or in grouplist THEN
    send MPAK_received To APP
  ELSE
    P unknown_handling_normal
  ENDIF
WHEN CSUBCOM
  P REC_MPAK_CSUBCOM_FROM_LINK
WHEN DTESERV
  IF F.get rec man = MCU MAN or in flexlist or in grouplist THEN
    CASE MPAK.state
    WHEN ok,from mail
      P REC_MPAK_DTESERV_FROM_LINK_NORMAL
    WHEN OTHERWISE
      CASE MPAK.type
      WHEN LOGINREQ,SOSRX,VICESOSRX
        send MPAK_received to APP
      WHEN OTHERWISE
        ignore signal
      ENDCASE
    ENDCASE
  ELSE
    P unknown_handling_normal
  ENDIF
ENDCASE
END P_REC_MPAK_FROM_LINK

```

2.4.1 P_UNKNOWN_HANDLING_NORMAL

P_unknown_handling_normal

```

CASE next_state
WHEN idle
  set MPAK.UNKNOWN_F = 1
  send MPAK_to_transmit to LINK
  next_state = link_busy
WHEN die_state
  set MPAK.UNKNOWN_F = 1
  send MPAK_to_transmit to LINK
  next_state = sending_during_die
WHEN OTHERWISE
  save signal
ENDCASE
END P_unknown_handling_normal

```

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2.4.2 P_REC_MPAK_DTESERV_FROM_LINK_NORMAL

```
P_REC_MPAK_DTESERV_FROM_LINK_NORMAL
CASE MPAK.type
  WHEN LOGINRA
    Add personal subscription MAN to the flexlist
    send MPAK received to APP
  WHEN LOGINREF
    send MPAK received to APP
  WHEN LOGOUTORD
    remove personal subscription MAN from the flexlist
    send MPAK received to APP
  WHEN DIE
    IF next_state = idle or die_state THEN
      next_state = die_state
      send die to APP
    ELSE
      save_signal
    END
  WHEN LIVE
    IF next_state = idle or die_state THEN
      next_state = idle
      send live to APP
    ELSE
      save_signal
    END
  WHEN GROUPLIST
    replace grouplist
    set grouplist received flag
    send MPAK received to APP
    send group list information to data link layer
  WHEN AREALIST
    send area list information to data link layer
```

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```

WHEN ROAMORD,FLEXREQ,INFOREQ,ESNREQ
  IF next_state = idle or die_state THEN
    CASE MPAK.type
      WHEN ROAMORD      make MPAK.type ROAM
      WHEN FLEXREQ      make MPAK.type FLEXLIST
      WHEN INFOREQ      make MPAK.type INFO
      WHEN ESNREQ       make MPAK.type ESNINFO
    ENDCASE
    send MPAK to transmit to LINK
    CASE next_state
      WHEN idle      next_state = link busy
      WHEN die_state next_state = sending_during_die
    ENDCASE
  ELSE
    save_signal
  ENDIF
WHEN FLEXLIST
  replace flexlist.
  send MPAK_received to APP
WHEN TIME
  send MPAK_received to APP
WHEN OTHERWISE
  ignore signal
ENDCASE MPAK
END_P_REC_MPAK_DTESERV_FROM_LINK_NORMAL
  
```

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2.4.2.1 F_GET_REC_MAN

```

F_get_rec_man
  CASE MPAK.state
    WHEN ok,from_mail
      F_get_rec_man = MPAK.addressee
    WHEN OTHERWISE
      F_get_rec_man = MPAK.sender
  ENDCASE MPAK.state
END_F_get_rec_man

```

2.4.3 P_REC_MPAK_CSUBCOM_FROM_LINK

```

P_REC_MPAK_CSUBCOM_FROM_LINK
  CASE next_state
    WHEN idle
      P_REC_MPAK_CSUBCOM_FROM_LINK_IDLE
    WHEN link_busy,sending_during_die,stop_sending
      save_signal
    WHEN die_state
      P_REC_MPAK_CSUBCOM_FROM_LINK_DIE
    WHEN wait_for_hook_off_normal,
      wait_for_hook_off_fast,
      wait_for_hook_off_group
      P_REC_MPAK_CSUBCOM_FROM_LINK_WAIT
    WHEN speech_normal,speech_group
      P_REC_MPAK_CSUBCOM_FROM_LINK_SPEECH
    WHEN sending_conreq
      CASE MPAK.type
        WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ,
          CONFAST,ADDCONFAST,SOSCONFAST,CONORD
          save_signal
          send_order_to_return_MPAK_to_LINK
          next_state = stop_sending
        WHEN OTHERWISE
          ignore_signal
      ENDCASE MPAK
    WHEN sending_conrea
      IF MPAK.type DISCON THEN
        send_MPAK_received_to_APP
        send_order_to_return_MPAK_to_LINK
        next_state = stop_sending
      ELSE
        ignore_signal
        send_order_to_return_MPAK_to_LINK
        next_state = stop_sending
      ENDIF
    WHEN sending_discon
      save_signal
      send_order_to_return_MPAK_to_LINK
      next_state = stop_sending
    ENDCASE
END_P_REC_MPAK_CSUBCOM_FROM_LINK

```

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2.4.3.1 P_REC_MPAK_CSUBCOM_FROM_LINK_IDLE

```

P_REC_MPAK_CSUBCOM_FROM_LINK_IDLE
_CASE MPAK.type
WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ
CASE MPAK.state
WHEN ok
IF F_get_rec_man = MCU_MAN or in flexlist
start 60 second timer for hook off
SPEECH_REG.part here = MPAK.addressee
SPEECH_REG.other_part = MPAK.sender
SPEECH_REG.line = MPAK.line
SPEECH_REG.conn_id = MPAK.connection_identity
send MPAK_received to APP
next_state = wait_for_hook_off_normal
ELSE
P unknown_handling_csubcom
ENDIF
WHEN OTHERWISE
send speech_off to LINK
ENDCASE MPAK.state
WHEN CONFAST,ADDCONFAST,SOSCONFAST
CASE MPAK.state
WHEN ok
IF F_get_rec_man = MCU_MAN or in flexlist
start 10 second timer for hook off
SPEECH_REG.part here = MPAK.addressee
SPEECH_REG.other_part = MPAK.sender
SPEECH_REG.line = MPAK.line
SPEECH_REG.conn_id = MPAK.connection_identity
send MPAK_received to APP
next_state = wait_for_hook_off_fast
send speech_on to LINK
ELSE
P unknown_handling_csubcom
ENDIF
WHEN OTHERWISE
send speech_off to LINK
ENDCASE MPAK.state
WHEN CONORD
CASE MPAK.state
WHEN ok
IF F_get_rec_man in grouplist
start 60 second timer for hook off
send MPAK_received to APP
next_state = wait_for_hook_off_group
send speech_on to LINK
ELSE
send speech_off to LINK
ENDIF
WHEN OTHERWISE
send speech_off to LINK
ENDCASE MPAK.state
  
```

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```

WHEN OTHERWISE
  send speech_off to LINK
ENDCASE MPAK
END_P_REC_MPAK_CSUBCOM_FROM_LINK_IDLE

```

2.4.3.2 P_UNKNOWN_HANDLING_CSUBCOM

```

P_unknown_handling_csubcom
  send speech_on to LINK
  make MPAK DISCON with
    MPAK.sender = received_MPAK.addressee
    MPAK.addressee = received_MPAK.sender
    MPAK.line = received_MPAK.line
    MPAK.connection_identity =
      received_MPAK.connection_identity
    MPAK.UNKNOWN_F = 1
  send MPAK to transmit to LINK
  next_state = sending_discon
END_P_unknown_handling_csubcom

```

2.4.3.3 P_REC_MPAK_CSUBCOM_FROM_LINK_DIE

```

P_REC_MPAK_CSUBCOM_FROM_LINK_DIE
CASE MPAK.type
  WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ,
    CONFAST,ADDCONFAST,SOSCONFAST
    CASE MPAK.state
      WHEN ok
        send speech_on to LINK
        make MPAK DISCON with
          MPAK.sender = received_MPAK.addressee
          MPAK.addressee = received_MPAK.sender
          MPAK.line = received_MPAK.line
          MPAK.connection_identity =
            received_MPAK.connection_identity
        IF P_get_rec_man = MCU_MAN or in_flexlist
          send MPAK to transmit to LINK
        ELSE
          set UNKNOWN_F = 1 in MPAK DISCON
          send MPAK to transmit to LINK
        ENDDIF
        next_state = sending_during_die
      WHEN OTHERWISE
        send speech_off to LINK
    ENDCASE MPAK.state
  WHEN OTHERWISE
    send speech_off to LINK
END_P_REC_MPAK_CSUBCOM_FROM_LINK_DIE

```

Diagrams

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2.4.3.4 P_REC_MPAK_CSUBCOM_FROM_LINK_WAIT

P_REC_MPAK_CSUBCOM_FROM_LINK_WAIT

CASE MPAK.type

WHEN DISCON

reset hook off timeout
 send speech off to LINK
 send MPAK_received to APP
 next state = idle

WHEN CONORD

ignore signal
 IF next_state < > wait_for_hook_off_group THEN
 reset hook off timeout
 send speech off to LINK
 next state = idle
 make MPAK DISCON
 send MPAK_received to APP

ENDIF

ENDCASE

END_P_REC_MPAK_CSUBCOM_FROM_LINK_WAIT

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 MTS09C.2

2.4.3.5 P_REC_MPAK_CSUBCOM_FROM_LINK_SPEECH

```
P_REC_MPAK_CSUBCOM_FROM_LINK_SPEECH
CASE MPAK.type
WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ,
CONFST,ADDCONFST,SOSCONFST
CASE MPAK.state
WHEN no_transfer,illegal,congest,error,busy
send speech_off to LINK
send MPAK_received to APP
next_state = idle
WHEN OTHERWISE
ignore_signal
make MPAK DISCON
send MPAK_received to APP
send speech_off to LINK
next_state = idle
ENDCASE MPAK.state
WHEN DISCON
send MPAK_received to APP
send speech_off to LINK
next_state = idle
WHEN CONORD
ignore_signal
IF next_state < > speech_group THEN
make MPAK DISCON
send MPAK_received to APP
send speech_off to LINK
next_state = idle
ENDIF
WHEN OTHERWISE
ignore_signal
make MPAK DISCON
send MPAK_received to APP
send speech_off to LINK
next_state = idle
ENDCASE
END_P_REC_MPAK_CSUBCOM_FROM_LINK_SPEECH
```

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 Rev: A

File Name: MTS09C.2

2.5 P_MPAK_TRANSMITTED

P_MPAK_TRANSMITTED

```

activated = TRUE
CASE MPAK.class
WHEN PSUBCOM,PSOSCOM,DTERSERV
  CASE next_state
  WHEN link_busy
    next_state = idle
  WHEN sending_during_die
    next_state = die_state
  ENDCASE
IF MPAK.UNKNOWN_F = 0 THEN
  IF MPAK.class = DTERSERV THEN
    CASE MPAK.type
    WHEN LOGINREQ,SOSRX,VICESOSRX
      send returned_MPAK_with_code:SENT to APP
    WHEN INACTIVE
      IF power_off THEN
        set power_off_ready
      ENDIF
      IF manual mode on received THEN
        set manual_mode
      ENDIF
    ENDCASE
  ELSE
    send returned_MPAK_with_code:SENT to APP
    IF (MPAK.class = PSUBCOM) AND (buffer_full_flag) THEN
      make MPAK INACTIVE
      send MPAK to transmit to LINK
      next_state = link_busy
    ENDIF MPAK.class
  ENDIF MPAK.class
ENDIF MPAK.UNKNOWN_F
WHEN CSUBCOM
  CASE MPAK.type
  WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ,
    CONFST,ADDCONFST,SOSCONFST
    send speech on to LINK
    send returned_MPAK_with_code:SENT to APP
    next_state = speech_normal
  WHEN CONREQ
    send speech on to LINK
    send returned_MPAK_with_code:SENT to APP
    next_state = speech_normal
  WHEN DISCON
    send speech off to LINK
    send returned_MPAK_with_code:SENT to APP
    IF next_state = sending_during_die THEN
      next_state = die_state
    ELSE
      next_state = idle
    ENDIF
  ENDCASE MPAK
ENDCASE MPAK.class
END P_MPAK_TRANSMITTED

```

Backup

Replay

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 Defect: Data Rev Pn. File
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2.6 P_MPAK_NOT_TRANSMITTED

P_MPAK_NOT_TRANSMITTED

```

CASE MPAK.class
  WHEN PSUBCOM,PSOSCOM,DIESERV
    CASE next_state
      WHEN link_busy
        next_state = idle
      WHEN sending_during_die
        next_state = die_state
      WHEN stop_sending
        next_state = idle
    ENDCASE
    IF MPAK.UNKNOWN_F = 0 THEN
      IF MPAK.class = DIESERV THEN
        CASE MPAK.type
          WHEN LOGINREQ,SOSRX,VICESOSRX
            send returned_MPAK_with_code:NOT_SENT to APP
          WHEN INACTIVE
            IF power_off THEN
              set power_off_ready
            ENDIF
            IF manual_mode_on received THEN
              set manual_mode
            ENDIF
          ENDCASE
        ELSE
          send returned_MPAK_with_code:NOT_SENT to APP
        ENDIF MPAK.class
      ENDIF MPAK.UNKNOWN_F
    WHEN CSUBCOM
      CASE MPAK.type
        WHEN CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ,
          CONFAS,ADDCONFAS,SOSCONFAS
          IF next_state = sending_conreq THEN
            send speech_off to LINK
          ENDIF
          next_state = idle
        WHEN CONREA
          send speech_off to LINK
          next_state = idle
        WHEN DISCON
          send speech_off to LINK
          IF next_state = sending_during_die THEN
            next_state = die_state
          ELSE
            next_state = idle
          ENDIF
        ENDCASE MPAK
        send returned_MPAK_with_code:NOT_SENT to APP
      ENDCASE MPAK.class
    END P_MPAK_NOT_TRANSMITTED
  
```

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2.7 P_HOOK_ON_HANDLING

P_HOOK_ON_handling

```

_CASE next_state
  WHEN wait_for_hook_off_normal,
    wait_for_hook_off_fast,
    wait_for_hook_off_group
    reset_hook_off_timeout
    P_timeout_handling

  WHEN sending_conreq,sending_conrea
    save_signal
    send_order_to_return_MPAK to LINK
    next_state = stop_sending

  WHEN speech_normal
    make MPAK DISCON with
      MPAK.sender = SPEECH_REG.part_here
      MPAK.addressee = SPEECH_REG.other_part
      MPAK.line = SPEECH_REG.line
      MPAK.connection_identity = SPEECH_REG.conn_id
    send MPAK to_transmit to LINK
    next_state = sending_discon

  WHEN speech_group
    send_speech_off to LINK
    next_state = idle

  WHEN idle
    IF line connection request received THEN
      make MPAK DISCON with
        MPAK.sender = SPEECH_REG.part_here
        MPAK.addressee = SPEECH_REG.other_part
        MPAK.line = SPEECH_REG.line
        MPAK.connection_identity = SPEECH_REG.conn_id
      send MPAK to_transmit to LINK
      next_state = sending_discon
    ELSE
      ignore_signal
    ENDIF
  WHEN OTHERWISE
    ignore_signal
  ENDCASE next_state
END_P_HOOK_ON_handling

```

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Date 1990-02-23 Ver A P. 7.2 MTS09C.2

2.8 P_TIMEOUT_HANDLING

```

P_timeout_handling
CASE next_state
WHEN wait_for_hook_off_normal,wait_for_hook_off_fast
  send speech on to LINK
  make MPAK DISCON with
    MPAK.sender = SPEECH_REG.part here
    MPAK.addressee = SPEECH_REG.other_part
    MPAK.line = SPEECH_REG.line
    MPAK.connection_identity = SPEECH_REG.conn_id
  send MPAK to transmit to LINK
  next_state = sending_discon

WHEN wait_for_hook_off_group
  send speech off to LINK
  next_state = idle

WHEN OTHERWISE
  ignore_signal
ENDCASE next_state
END P_timeout_handling

```

2.9 P_HOOK_OFF_HANDLING

```

P_HOOK_OFF_handling
CASE next_state
WHEN wait_for_hook_off_normal
  reset hook_off timeout
  make MPAK CONREA with
    MPAK.sender = SPEECH_REG.part here
    MPAK.addressee = SPEECH_REG.other_part
    MPAK.line = SPEECH_REG.line
    MPAK.connection_identity = SPEECH_REG.conn_id
  send MPAK to transmit to LINK
  next_state = sending_conrea

WHEN wait_for_hook_off_fast
  reset hook_off timeout
  next_state = speech_normal

WHEN wait_for_hook_off_group
  reset hook_off timeout
  next_state = speech_group

WHEN OTHERWISE
  ignore_signal
ENDCASE next_state
END P_HOOK_OFF_handling

```

Blockout

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2.10 P_ROAMING_HANDLING

```

P_roaming_handling
  IF next_state = idle or die_state THEN
    IF grouplist_received_flag THEN
      make MPAK ROAM
    ELSE
      make MPAK BORN
    ENDIF
    send MPAK_to_transmit to LINK
    CASE next_state
      WHEN idle
        next_state = link_busy
      WHEN die_state
        next_state = sending_during_die
    ENDCASE
  ELSE
    save_signal
  ENDIF
END_P_roaming_handling

```

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Diagram

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2.11 P_ACTIVATION_HANDLING

```
P activation handling
  IF NOT buffer_full_flag THEN
    activated = FALSE
    start activation timer with 'active_delay_power_on'
  ENDIF
END P_activation_handling
```

2.12 P_ACTIVATION_HANDLING_LINK

```
P activation handling link
  IF NOT buffer_full_flag THEN
    activated = FALSE
    start activation timer with 'active_delay_lost_contact'
  ENDIF
END P_activation_handling_link
```

2.13 P_ACTIVATION_TIMEOUT_HANDLING

```
P activation timeout handling
  IF next_state = idle or die_state THEN
    IF NOT activated THEN
      make MPAR ACTIVE
      send MPAR to transmit to LINK
      CASE next_state
        WHEN idle
          next_state = link_busy
        WHEN die_state
          next_state = sending_during_die
      ENDCASE
    ENDIF
  ELSE
    save_signal
  ENDIF
END P_activation_timeout_handling
```

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2.14 P_POWER_OFF_HANDLING

```

P_power_off_handling
power_off received
start power_off timer
CASE next_state
WHEN idle
  make MPAK INACTIVE
  send MPAK_to_transmit to LINK
  next_state = link_busy
WHEN die_state
  make MPAK INACTIVE
  send MPAK_to_transmit to LINK
  next_state = sending_during_die
WHEN speech_normal,speech_group,wait_for_hook_off_normal,
  wait_for_hook_off_fast,wait_for_hook_off_group,
  sending_conrea,sending_discon,sending_conreq
  disconnect the speech (according to current state)
  make MPAK INACTIVE
  send MPAK_to_transmit to LINK
  next_state = link_busy
WHEN OTHERWISE
  save_signal
ENDCASE
END P_power_off_handling
          
```

2.15 P_MANUAL_MODE_ON_HANDLING

```

P_manual_mode_on_handling
manual_mode_on received
start manual_mode_on_timer
CASE next_state
WHEN idle
  make MPAK INACTIVE
  send MPAK_to_transmit to LINK
  next_state = link_busy
WHEN die_state
  make MPAK INACTIVE
  send MPAK_to_transmit to LINK
  next_state = sending_during_die
WHEN speech_normal,speech_group,wait_for_hook_off_normal,
  wait_for_hook_off_fast,wait_for_hook_off_group,
  sending_conrea,sending_discon,sending_conreq
  disconnect the speech (according to current state)
  make MPAK INACTIVE
  send MPAK_to_transmit to LINK
  next_state = link_busy
WHEN OTHERWISE
  save_signal
ENDCASE
END P_manual_mode_on_handling
          
```

Design

Review

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		EC File MTS09C.2

2.16 P_BUFFER_FULL_HANDLING

```

P_buffer_full_handling
CASE next_state
WHEN idle
    make MPAK INACTIVE
    send MPAK_to_transmit to LINK
    next_state = link_busy
WHEN die_state
    make MPAK INACTIVE
    send MPAK_to_transmit to LINK
    next_state = sending_during_die
WHEN speech_normal,speech_group,wait_for_hook_off_normal,
    wait_for_hook_off_fast,wait_for_hook_off_group,
    sending_conreq,sending_discon,sending_conreq
    disconnect the speech (according to current state)
    make MPAK INACTIVE
    send MPAK_to_transmit to LINK
    next_state = link_busy
WHEN OTHERWISE
    save signal
ENDCASE

send buffer_full to APP
set buffer_full_flag

END_P_buffer_full_handling
    
```

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Doc. Date
1990-02-23

Rev.
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3 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 4, 6
RI-09, 7, 18

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
RI-01	Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

References

References

System Name 1988 ET/SYS PES	Facilitating Subsystem ET/SYS PES	St. No. 6/1056 - A 296 5171 Ue	
System Category - Description ET/SYSC STP		Design Date 1990-02-26	Rev E
		File No. MTS11HDLCL.1	
<p>Bezeichnung</p> <p>Cantel Mobitex</p>		<p>Title</p> <p>MOBITEX HDLCL interface Fixed terminal</p>	
<p><u>ABSTRACT</u></p> <p>This document is a specification of the interface for a fixed terminal with HDLC interface, connected to the MOBITEX network.</p>			
<p>Blanket</p> <p>Reprod</p>			

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Signature

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1 INTRODUCTION

1.1 GENERAL

The designation "terminal" for a fixed terminal in the MOBITEX network corresponds to DTE in CCITT recommendations and secondary station in HDLC.

CCITT recommendation X.21 bis is used at the physical layer and HDLC is used at the link layer. The network layer consists of MPAK's according to reference R1-09.

Endorse

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2 PHYSICAL LAYER

2.1 GENERAL

Connection is in accordance with CCITT recommendation X.21 bis.

2.2 BITRATE

For information about permitted bitrate transmission rates, please refer to reference R1-06.

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6/1056 - A 296 5171 Ue
 1990-02-26 E MTS11HDLC.1

3 LINK LAYER

3.1 GENERAL

The design of the link layer follows ISO standards "High level data link control" (HDLC). See ISO 3309-1984, ISO 4335-1984 and ISO 7809-1984 for reference.

3.2 SUB-SET OF HDLC

HDLC is a comprehensive catalogue of standards for link control. The UNC 12 class, i.e. "Unbalanced operation, normal response mode" with added test function, of procedure is used for the link layer.

The MOBITEK network is the primary station and the fixed terminal is the secondary station.

3.2.1 Clarification

3.2.1.1 Commands and responses

The following commands and responses are obtained with the above class:

Command from network	Response from fixed terminal
I	I
RR	RR
RNR	RNR
SNRM	UA
DISC	DM
TEST	FRMR
	TEST

3.2.1.2 Frame size

A frame can be up to 566 octets including start and stop flag. This will allow 560 octets in an information field in an I frame.

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3.2.1.3 The use of the address field

The address field comprises one octet. The address in the address field shall be adjustable. The factory set address shall be 11000000 (bit 1...8).

Address 11111111 is defined as the all-station address and thus all receiving data stations shall accept and action the associated frame. If the P bit is set in such a frame, the terminal shall reply with its own address as reply address.

3.2.1.4 FRMR responses

The information field in an FRMR response shall be padded with zeros so the length will be 3 octets.

3.2.1.5 TEST frames

TEST frames can contain an information field. The maximum length of that field is the same as for I-frames.

TEST frames can be transmitted and received both in NRM and NDM.

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3.3 OPERATING MODES FOR THE LINK LAYER

The link layer shall be able to assume the following modes:

- o Normal response mode (NRM) according to ISO 4335 item 5.1.1.
- o Normal disconnected mode (NDM) according to ISO 4335 items 5.2 and 5.2.1.

A terminal's capacity in NDM is limited to:

- accepting the mode setting commands (SNRM or DISC)
- accepting and responding to a test command
- transmitting DM or TEST at a respond opportunity

A terminal may only change to NRM from NDM by accepting an SNRM command from the network.

A terminal can change from NRM to NDM by accepting a DISC command from the network or through manual restart of the link control. NDM shall be the initial mode when power is switched on or when restarting the terminal.

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3.4 CONNECTION AND DISCONNECTION PROCEDURE

The link is connected in accordance with ISO 7809 item 3.4.1.1. The network transmits SNRM to the terminal. If there is no reply, the SNRM is retransmitted until an UA reply is received.

Normal disconnection of the link is in accordance with ISO 7808, item 3.4.1.2. If there is no reply from the terminal, DISC is retransmitted. This is repeated no more than 10 times or until an UA reply is received. The link is then assumed to be disconnected and the connection at the lower level can be broken.

If there are no frames to send, the link layer shall send flags continuously as soon as the physical layer is in data transmission mode.

3.5 TIME-OUT

When the terminal receives a correct frame with the P bit set to "1" (one), the reply shall commence within 50 ms. The time is calculated from when the last bit of the command's closing flag is received until the first bit of the response is transmitted.

If several frames are transmitted in sequence, the time between them shall not exceed 50 ms. This time is calculated from the last bit of a frame's closing flag to the first bit of the next frame's opening flag.

The terminal has no time-out function for recovery in the event of a link fault. The terminal however may have time-out function to inform the operator about a link fault. The time-out may not be less than 45s in NRM and 120 s in NDM.

3.6 RECOVERY FROM FAULT CONDITION

All recovery from a fault condition is carried out by the network. The terminal is first ordered to NDM and then to NRM.

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4 MOBITEK TERMINAL-SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 4
RI-09, 3

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
RI-01	.. Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

The following external references are made in this document:

CCITT recommendations series X, 1984 Edition (Red Book) X.21 bis

ISO-standards:

ISO 3309-1984(E)
ISO 4335-1984(E)
ISO 7809-1984(E)

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Original - French 1988 ET/SYS PES	Filmsaving - Report response ET/SYS PES	No. No 1056 - A 296 5491 Ue			
Declarer Outlines - Description approuvée ET/SYSC STT <i>577</i>		<table border="1"> <tr> <td>Docum. Date 1990-02-26</td> <td>File C</td> <td>Pl. File MTS11X25.1</td> </tr> </table>	Docum. Date 1990-02-26	File C	Pl. File MTS11X25.1
Docum. Date 1990-02-26	File C	Pl. File MTS11X25.1			
Remarque Cantel Mobitex -		Title MOBITEX X.25 interface Fixed terminal			
<p style="text-align: center;"><u>ABSTRACT</u></p> <p>This document is a specification of the interface for a fixed terminal with X.25 interface, connected to the MOBITEX network.</p>					
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Cantel Mobitex

No. 1056 - A 296 5491 Ue	
Datum: 1990-02-26	PC F. MTS11X25.1

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No. 1056 - A 296 5491 Ue

Date: 1990-02-26 Rev. C

File: MTS11X25.1

1 INTRODUCTION

1.1 GENERAL

The designation 'terminal' for a fixed terminal in the MOBITEK network corresponds to DTE in CCITT recommendations for X.25 packet layer and link layer.

Connection of a terminal with X.25-interface can be done directly to the MOBITEK network or through an X.25 network.

CCITT recommendation X.21 bis is used at the physical layer, LAPB is used at the link layer and X.25 is used at the packet layer.

The user data in X.25 packet layer should contain MPAKs as described in reference R1-09.

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2 PHYSICAL LAYER

2.1 GENERAL

Connection is in accordance with CCITT recommendation X.21 bis.

2.2 BITRATE

For information about permitted bitrate transmission rates, please refer to reference R1-06.

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3 LINK LAYER

The design of the link layer follows LAPB, Link Access Procedure Balanced, according to CCITT recommendation X.25.

The extended format modulo 128 is not supported.

The multilink procedure MLP is not supported.

Timeout period is T1=3 seconds.

Maximum number of outstanding frames are K=7.

Number of retransmission attempts are N2=10.

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4 PACKET LAYER

The design of the packet layer follows CCITT recommendation X.25 for DTE with the following restrictions:

When the terminal is using direct connection there is only one logical channel. The logical channel group number should be zero and the logical channel number should be one.

When connection is made through an X.25 network, maximum number of logical channels are 8.

The delivery-bit should be set to zero in all data packets.

The qualifier-bit is ignored by the MOBITEK network.

The sequence numbering scheme of the data packets is performed modulo 8.

The standard default value for the window size is two packets. It is possible to change the default window size to 1, 3, 4, 5, 6 or 7 packets.

The standard default value for the packet size is 128 octets. It is possible to change the default packet size to 32, 64, 256, or 512 octets.

Interrupt, reject and registration packets are not supported.

The following facilities are supported:

- Flow control parameter negotiation.
- Non standard default packet size.
- Non standard default window size.
- Reverse charging. (See note 1.)
- Reverse charging acceptance. (See note 1.)

A connected terminal can communicate with MOBITEK through a permanent virtual circuit (PVC) or through a virtual circuit (VC).

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If no packets, in either direction, has been transmitted on the logical channel during X (default 4 and possible to change) minutes a virtual call will be cleared by the MOBITEK network if the connection is VC.

Note 1 : Only used when connected through an X.25 network.

The packet call request/incoming call and call accepted/call connected should contain both calling DTE address and called DTE address (optional in CCITT X.25).

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4.1 Diagnostic codes

Coding of the restarting cause field and the diagnostic code field in a restart packet, used by the MOBITEK network and the connected terminal.

cause	diag.	explanation
00		local procedure error
	17	invalid packet type for state r1
	52	time expired for restart indication
07		network operational

Coding of the clearing cause field and the diagnostic code field in a clear packet, used by the MOBITEK network and the connected terminal.

cause	diag.	explanation
0		dte originated
	0	dte clearing
01		number busy
	72	call collision
03		invalid facility request
	65	facility code not allowed
	66	facility parameter not allowed
19		local procedure error
	20	invalid packet type for state p1
	21	invalid packet type for state p2
	22	invalid packet type for state p3
	24	invalid packet type for state p4
	26	invalid packet type for state p6
	33	unidentifiable packet
	38	packet too short
	41	restart with nonzero in bits 1-4 in octet 1 or nonzero in bits 1-8 in octet 2
	49	time expired for incoming call
	50	time expired for clear indication
	51	time expired for reset indication
	67	invalid called address
	68	invalid calling address
	69	invalid facility length

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Coding of the resetting cause field and the diagnostic code field in a reset packet, used by the MOBITEK network and the connected terminal.

<u>cause</u>	<u>diag.</u>	<u>explanation</u>
05		local procedure error
	01	invalid p(s)
	02	invalid p(r)
	27	invalid packet type for state dl
	32	packet type not allowed (registration or interrupt packet)
	35	invalid packet type on pvc channel
	37	reject packet not subscribed
	41	restart with nonzero in bits 1-4 in octet 1 or nonzero in bits 1-8 in octet 2
	51	time expired for reset indication

Coding of the diagnostic code field in a diagnostic packet, used by the MOBITEK network and the connected terminal.

<u>diag.</u>	<u>explanation</u>
36	packet on unassigned logical channel
38	packet too short
40	invalid general format identifier
50	time expired for clear indication
51	time expired for reset indication
52	time expired for restart indication

Backport

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5 MOBITEK NETWORK LAYER

The MPAK should be placed in the user data field in one or more X.25 data packets. An MPAK should be handled as a complete packet sequence, according to CCITT's X.25 recommendation # 4.3.5.

Note: The D-bit should always be set to zero in communication with the MOBITEK network.

If the transmission of an MPAK is interrupted by a restart, reset or clear procedure the whole MPAK should be retransmitted.

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6 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 4
R1-09, 3

Below are the reference designations listed.

Reference	Section
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

The following external references are made in this document:

CCITT recommendations series X, 1984 edition (Red book) X.25 and X.21 bis

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REQUIREMENT SPECIFICATION Rev. 1(17)

Uppgavs-Prepared	Förhandsläggning Subject/Response	Sty No	1056 - A 296 5490	Ue
1988 ET/SYS PES	ET/SYS PES	Docum - Data	1 Rev	File File
Dokument Granskad - Doc response approved		1990-02-26	C	MTS11BSC.1
ET/SYSC STT <i>ST</i>				
Benämning		Titel		
Cantel Mobitex -		MOBITEX BSC interface Fixed terminal		
<p><u>ABSTRACT</u></p> <p>This document is a specification of the interface for a fixed terminal with binary synchronous communication (BSC) interface, connected to the MOBITEX network.</p>				
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1 INTRODUCTION

1.1 GENERAL

The designation "terminal" for a fixed terminal in the MOBITEX network corresponds to DTE in CCITT recommendations.

CCITT recommendation X.21 bis is used at the physical layer. The link layer is IBM's BSC (binary synchronous communication), see chapter 2.

The network layer is a character oriented MPAK (BSCPAK), see chapter 4.

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Diagram

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2 PHYSICAL LAYER

2.1 GENERAL

Connection is in accordance with CCITT recommendation X.21 bis.

2.2 BITRATE

For information about permitted bitrate transmission rates, please refer to reference R1-06.

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3 LINK LAYER

The design of the link layer follows IBM General Information - Binary Synchronous Communications, GA27-3004 with the following restrictions:

Point-to-point connection is used. The Mobitex network has a retry timeout of 3 seconds.

ITB and RVI will be handled by the Mobitex network when received, but is never transmitted.

Transparent mode is not handled by the Mobitex network.

SOH can be received but the content of the header is not interpreted. SOH is never transmitted.

The Mobitex network retransmits max 15 times.

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4 NETWORK LAYER

The network layer use BSCPAK. A BSCPAK is a character-oriented MPAK, MPAKs are bit-oriented and are described in reference R1-09.

BSCPAK is EBCDIC-coded, see chapter 6.

All MPAK, except MPAK DATA, HPDATA and EXTPAK can be translated to BSCPAK.

Sendlist is not handled.

All numeric fields are right adjusted with preceding zeroes.

BSCPAK shall be handled in the same way as corresponding MPAK.

Maximum length for a BSCPAK is 548 octets (BSCPAK TEXT without sendlist).

A BSCPAK may be divided into several blocks, each of which ends with ETB except the last one which ends with ETX.

The content of the text field in a BSC-block is a BSCPAK (or part of BSCPAK) in either direction, to or from the Mobitex network.

STX precedes and ETX ends a BSCPAK.

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5 SPECIFICATION OF BSCPAK

BSCPAK shall be handled, according to reference R1-09, in the same way as corresponding MPAK. Below is a description of the translation between bit-oriented MPAK and the character oriented BSCPAK.

All BSCPAKs consist of one BSCPAK header and one part with typedependent components.

All characters in a BSCPAK shall be in EBCDIC code.

5.1 BSCPAK, COMMON COMPONENTS

BSCPAK-field	octet	comment
sender	1-8	only digits
addressee	9-16	only digits
class	17	only digits
extern_F	18	0 or 1
type	19-20	only digits
mailbox_F	21	0 or 1
digital_F	22	0 or 1
sendlist_F	23	0
unknown_F	24	0 or 1 (0 from Mobitex)
reserve_F	25	0
trafstate	26	0 ... 7 (0 to Mobitex)

Length 26 octets.

Ex. sender = 123456

octet 1

0

0

1

2

3

4

5

octet 8

6

Octet 1 will be transmitted first.

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5.2 BSCPAK COMPONENTS

The following components are described in this chapter:

TEXT
STATUS
SOSINFO
SOSACK
CONREQ
SOSCONREQ
ADDCONREQ
CONGRA
CONORD
CONREA
DISCON
EXTCONREQ
CLOOFON
CLOOPOFF
LOGINREQ
LOGINRA
LOGINREF
LOGOUT
LOGOUTORD
ACTIVE
INACTIVE
DIE
LIVE
VICESOSRX
SOSRX
GROUPLIST
FLEXREQ
FLEXLIST
TIME

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* TEXT without adress list:

BSCPAK-field	octet	comment
bbscpak-header	1-26	
time	27-36	decimal digits (YYMMDDHHMM)
text	37-	all characters included in Mobitex textcode (EBCDIC-coded), 1-512 characters

Length 37-548 octets.

* STATUS without adress list:

BSCPAK-field	octet	comment
bbscpak-header	1-26	
time	27-36	decimal digits (YYMMDDHHMM)
status code	37-39	only digits 000 ... 255

Length 39 octets.

* SOSINFO

BSCPAK-field	octet	comment
bbscpak-header	1-26	
time	27-36	decimal digits (YYMMDDHHMM)
static emergency information	37-	all characters included in Mobitex textcode (EBCDIC-coded), 0-256 characters
dynamic emergency information	37-	all characters included in Mobitex textcode (EBCDIC-coded), 0-256 characters

Length 36-548 octets.

* SOSACK

BSCPAK-field	octet	comment
bbscpak-header	1-26	
time	27-36	decimal digits (YYMMDDHHMM)
emergency acknowledgement status	37-39	decimal digits 000..255

Length 39 octets.

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* CONREQ

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255

Length 32 octets.

* SOSCONREQ

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255

Length 32 octets.

* ADDCONREQ

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255
additional information	33-52	all characters included in Mobitex textcode (EBCDIC- coded)

Length 52 octets.

* CONGRA

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255

Length 32 octets.

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Dates: Jan 1990-02-26 File C File
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* CONORD

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255

Length 32 octets.

* CONREA

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255

Length 32 octets.

* DISCON

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255

Length 32 octets.

* EXTCONREQ

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)
connection identity	30-32	decimal digits 000..255
subscr. no. in ext. network	33-52	decimal digits

Length 52 octets.

* CLOOPON

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)

Length 29 octets.

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* CLOOPOFF

BSCPAK-field	octet	comment
bscpak-header	1-26	
line number	27-29	decimal digits 000..255 (000 from terminal)

Length 29 octets.

* LOGINREQ

BSCPAK-field	octet	comment
bscpak-header	1-26	
MAN	27-34	only decimal digits
password	35-42	all characters included in Mobitex textcode (EBCDIC- coded)

Length 42 octets.

* LOGINGRA

BSCPAK-field	octet	comment
bscpak-header	1-26	
MAN	27-34	only decimal digits

Length 34 octets.

* LOGINREF

BSCPAK-field	octet	comment
bscpak-header	1-26	
MAN	27-34	only decimal digits

Length 34 octets.

* LOGOUT

BSCPAK-field	octet	comment
bscpak-header	1-26	
MAN	27-34	only decimal digits

Length 34 octets.

Budget

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St. No.	1056 - A 296 5490	De
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* LOGOUTORD

BSCPAK-field	octet	comment
bscpak-header	1-26	
MAN	27-34	only decimal digits

Length 34 octets.

* ACTIVE

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

* INACTIVE

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

* DIE

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

* LIVE

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

* VICESOSRX

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

* SOSRX

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

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* GROUPLIST

BSCPAK-field	octet	comment
bscpak-header	1-26	
number of MAN	27-28	1..15
MAN 1	29- 36	only decimal digits
MAN 2	37- 44	only decimal digits
MAN 3	45- 52	only decimal digits
MAN 4	53- 60	only decimal digits
MAN 5	61- 68	only decimal digits
MAN 6	69- 76	only decimal digits
MAN 7	77- 84	only decimal digits
MAN 8	85- 92	only decimal digits
MAN 9	93-100	only decimal digits
MAN 10	101-108	only decimal digits
MAN 11	109-116	only decimal digits
MAN 12	117-124	only decimal digits
MAN 13	125-132	only decimal digits
MAN 14	133-140	only decimal digits
MAN 15	141-148	only decimal digits

Length 148 octets.

* FLEXREQ

BSCPAK-field	octet	comment
bscpak-header	1-26	

Length 26 octets.

* FLEXLIST

BSCPAK-field	octet	comment
bscpak-header	1-26	
number of MAN	27	1..7
MAN 1	28-35	only decimal digits
MAN 2	36-43	only decimal digits
MAN 3	44-51	only decimal digits
MAN 4	52-59	only decimal digits
MAN 5	60-67	only decimal digits
MAN 6	68-75	only decimal digits
MAN 7	76-83	only decimal digits

Length 83 octets.

* TIME

BSCPAK-field	octet	comment
bscpak-header	1-26	
time	27-36	decimal digits (YYMMDDHHMM)

Length 36 octets.

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6 TRANSLATION BETWEEN ASCII AND EBCDIC

ASCII EBCDIC

09	05
0A	25
0C	0C
0D	0D
20	40
21	5A
22	7F
23	7B
24	5B
25	6C
26	50
27	7D
28	4D
29	5D
2A	5C
2B	4E
2C	6B
2D	60
2E	4B
2F	61
30	F0
31	F1
32	F2
33	F3
34	F4
35	F5
36	F6
37	F7
38	F8
39	F9
3A	7A
3B	5E
3C	4C
3D	7E
3E	6E
3F	6F
40	7C
41	C1
42	C2
43	C3
44	C4
45	C5
46	C6
47	C7
48	C8
49	C9
4A	D1
4B	D2
4C	D3
4D	D4
4E	D5

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4F D6
50 D7
51 D8
52 D9
53 E2
54 E3
55 E4
56 E5
57 E6
58 E7
59 E8
5A E9
5B 4A
5C E0
5D 4F
5E 5F
5F 6D
60 79
61 81
62 82
63 83
64 84
65 85
66 86
67 87
68 88
69 89
6A 91
6B 92
6C 93
6D 94
6E 95
6F 96
70 97
71 98
72 99
73 A2
74 A3
75 A4
76 A5
77 A6
78 A7
79 A8
7A A9
7B C0
7C 6A
7D D0
7E A1

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7 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 4
RI-09, 6, 7

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RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

The following references are made in this document:

CCITT recommendations series V, 1984 Edition (Red books) X.21 bis.

IBM General Information - Binary Synchronous Communications, GA27-3004.

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Upper: Prepared 1988 ET/SYS PES	Facilities: Subject response ET/SYS PES	Sr No 1056 - A 296 5516	Ue
Delivered: Delivered - Op response ET/SYSC STT 57		Deliver Date 1990-02-26	Rev D
Designation		File MOBITEX MASC interface Fixed terminal	
<h1>Cantel Mobitex</h1>			
<p>ABSTRACT</p> <p>This document is a specification of the interface for a fixed terminal with MOBITEK Asynchronous Communication (MASC) interface, connected to the MOBITEK network.</p>			
<p>Buildings</p> <p>Revised</p>			

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		P. 1.1
		MTS11MASC.1

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3.4	START WITH NO SUBSCRIPTION NUMBER	6
4	MOBITEX TERMINAL SPECIFICATION REFERENCE LIST	7

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Cantel Mobitex-

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Doc. Date 1990-02-26	Rev. D	File No. MTS11MASC.1

1 INTRODUCTION

1.1 GENERAL

The designation "terminal" for a fixed terminal in the MOBITEK network correspond to DTE in CCITT recommendations.

CCITT recommendation V.24 is used at the physical layer and MASC interface is used at the link layer (reference R1-19 is used for link layer MASC). The network layer consists of MPAK's according to reference R1-09.

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2 PHYSICAL LAYER

2.1 GENERAL

Connection is in accordance with CCITT recommendation V.24/V.28.

Note: The physical layer of MASC is not directly compatible with the physical layer in the masc interface of a mobile terminal.

However this can be done by connecting the following signals in the mobile unit.

105	<input type="checkbox"/>
106	<input type="checkbox"/>
107	<input type="checkbox"/>
108/2	<input type="checkbox"/>
109	<input type="checkbox"/>

2.2 BITRATE

For information about permitted bitrate transmission rates, please see reference RI-06.

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3 LINK LAYER

3.1 GENERAL

The link layer sends, controls and acknowledge information between network and terminal. When faults are detected, the link layer handles retransmission.

The design of the link layer follows PROTOCOL FOR MASC TYPE TERMINALS, which is described in reference R1-19.

The data in information frame is MOBITEK packets (MPAK) which are described in reference R1-09.

3.2 FRAMES USED IN MASC

There are two different types of frames, control frames and information frames (see reference R1-19).

The following control frames are used:

- ACK Acknowledgement
- NACK Negative acknowledgement
- RACK Request for repetition of the latest sent ACK
- SENS Communication link control
- SACK Acknowledgement of a received SENS

Note: The network will not send the frame SENS by default.

Information frames are used with the following commands:

- B parameters in machine interface
- M send/receive MPAK
- E answer to an invalid command
- F P terminal MAN request and answer
- F Q masc device identity

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3.3 TIMEOUT

The masc interface uses two timers, which are described in reference R1-19.

Note: The network will handle the "30 seconds timeout" as follows:
If no answer is received within 30 seconds, the network will return the frame to the sender. The network will then try to start up the line with a B-command.

3.4 START WITH NO SUBSCRIPTION NUMBER

The terminal has the possibility to ask the network about the valid subscription number. When the line is in the connected mode, the terminal can ask the network about MOBITEK subscription number.

The terminal sends the F P command and receives the answer F PMAN from the network. The terminal will also receive an identification of the network in the F Q command.

The commands F P and F Q are described in reference R1-19.

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Fr. File	MTS11MASC.1

4 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

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RI-09, 3, 5
RI-19, 3, 5, 6

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RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

The following external references are made in this document:

CCITT recommendations series V, 1984 Edition (Red books) V.24 and V.28

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REQUIREMENT SPECIFICATION 1(7)

PROJECT NAME ET/SYS PES	PROJECT NAME ET/SYS PES	No. No. 1056 - A 296 5454 Ue	
PROJECT ORIGINATOR ET/SYSC STT <i>ST</i>		DATE 1990-02-27	P. No. M2S11MPAD.1
SUMMARY Cantel Mobitex		TITLE MOBITEX Asynchronous interface Fixed terminal MPAD	
<p><u>ABSTRACT</u></p> <p>This document describes the connection of an asynchronous terminal to the MPAD service in the MOBITEX network.</p>			
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Spec No		1056 - A 296 5454 Ue
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1990-02-27	C	MTS11MPAD.1

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MTS11MPAD.1

1 INTRODUCTION

1.1 GENERAL

The MPAD communicates with the terminal one character at a time with a start-stop protocol. The purpose with the MPAD service is to let customers use a standard terminal for communication with the MOBITEK network.

The designation "terminal" for a fixed terminal in the MOBITEK network corresponds to DTE in CCITT recommendations.

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Doc File	MTS11MPAD.1	

2 PHYSICAL LAYER

2.1 GENERAL

Connection is in accordance with CCITT recommendations V.24/V.28.

2.2 TERMINAL EQUIPMENT

An asynchronous terminal of start-stop type for serial data transmission is used. The communication uses 1 start bit, 8 data bits, 1 stop bit and no parity. The screen should be 24 lines x 80 columns. The terminal should have an advanced video option installed to use the reversed video facility.

If the MPAD-connected terminal has a printer port or auxiliary port, a printer can be connected to this port. Messages to/from the terminal can be directed to this printer if the terminal can interpret the printer-port setting commands described in chapter 3.

2.3 PRINTER EQUIPMENT (optional)

The printer should have at least 24 columns, preferably 80 columns width. The transmission rate and communication type depends on the available printer-port on the terminal. The printer should be able to use the same character-set as the terminal, see chapter 3.

2.4 BITRATE

For information about permitted transmission rates, please refer to reference R1-06.

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3 PROTOCOL FOR TERMINAL

The terminal should comply with ANSI/VT100 according to the following specifications that is a subset of ANSI X3.41 1974 and ANSI X3.64 1979.

The terminal should be able to :

- * transmit and receive all characters described in MOBITEX text code (please refer to reference R1-06).
- * transmit ASCII-character 127 (DEL).
- * receive ASCII-character 7 (bell) and then give an audible signal.
- * receive ASCII-character 10 (LF) and then do a line-feed.
- * receive ASCII-character 13 (CR) and then do a carriage return.
- * generate the control sequences described in chapter 3.1
- * interpret the control sequences described in chapter 3.2

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3.1 CONTROL SEQUENCES FROM TERMINAL TO MPAD

The following control sequences should preferably be generated by arrow-marked keys.

```
ESC O A      (arrow up)
ESC O B      (arrow down)
ESC O C      (arrow right)
ESC O D      (arrow left)
```

The following control sequences should preferably be generated by the keys on an auxiliary keypad.

```
ESC O p      (0)
ESC O q      (1)
ESC O r      (2)
ESC O s      (3)
ESC O t      (4)
ESC O u      (5)
ESC O v      (6)
ESC O w      (7)
ESC O x      (8)
ESC O y      (9)
ESC O m      (dash)
ESC O l (=lowercase L)(comma)
ESC O n      (period)
ESC O M      (ENTER)
ESC O P      (PF1)
ESC O Q      (PF2)
ESC O R      (PF3)
ESC O S      (PF4)
```

3.2 CONTROL SEQUENCES FROM MPAD TO TERMINAL

```
ESC =      Set terminal in keypad application mode
ESC 7      Save cursor
ESC 8      Restore cursor
ESC [ 7 m  Set reverse video
ESC [ 0 m  All video attributes off
ESC [ 5 i  Enter printer controller mode
ESC [ 4 i  Exit printer controller mode
ESC [ 0 k  Erase line after cursor
ESC E      Next line
ESC [ 20 h Set new line mode
ESC [ x;y H Move cursor to line x and column y
ESC [ ? 1 (=one) h Set cursor key mode
ESC [ 2 J  Erase all of the display
```

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4 MOBITEX TERMINAL SPECIFICATION REFERENCE LIST

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RI-20	Other requirements, mobile terminals

The following external references are made in this document:

CCITT recommendations series V, 1984 Edition (Red books) V.24 and V.28

ANSI X3.41 1974

ANSI X3.64 1979

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Upper Project 1988 ET/SYS Pes	Fieldwork/Investigations ET/SYS Pes	No. No 1056 - A 296 5176 Ue	
Design/Code/Doc reference/signature ET/SYSC STT <i>ST</i>		Date - Date 1990-02-26	Rev C
Revision		File No MTS12.1	
Cantel Mobitex -		Title MOBITEX Other requirements, Fixed terminals	
<p><u>ABSTRACT</u></p> <p>This document specifies general requirements for fixed terminals, connected to the MOBITEX network.</p>			
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 Section Date Rev. P.2. P.2.
 1990-02-26 C MTS12.1

1 GENERAL

A fixed terminal is connected with a line interface for packet switching and line connection for line connection traffic (primarily speech). If the fixed terminal is connected to the mains, there are certain requirements for electrical safety.

2 ELECTRICAL SAFETY

For information about electrical safety requirements, please refer to R1-06.

3 SPECIFICATION OF LINE CONNECTION

A fixed terminal should permit line connection traffic as a complement to message traffic. For this to be possible, it is necessary to have a real time connection between terminal and network in addition to the message traffic interface. A connection of this type can be used for transmitting speech for example.

For information about line connection requirements, please refer to R1-06.

TYPE OF CONNECTION: 4 wire speech connection with one speech direction per line pair.

CONNECTION: ISO DIS 8877 plug of European or U.S. type.

FREQUENCY RANGE: 300 - 3400 Hz

RECEIVER LEVEL DIRECTION -15 -- -30 dBm

SENDER LEVEL DIRECTION -10 -- -23 dBm

SIGNAL/NOISE RATION REC./SEND.: Greater than 40 dB

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4 MOBITEX TERMINAL SPECIFICATION REFERENCE LIST

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RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

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Cantel Mobitex -

No. 25

Revision Date

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EXPLANATION AND MODIFICATIONS

This chapter has been newly added. It is an addendum providing a preliminary specification of additional requirements for portable terminals designed for operation on the Mobitex network. The primary motivation for this addendum is the need to provide a low power operating mode for portable units, to extend the operating time of their self-contained batteries. Because enhancements have been made to network signalling protocols over the air interface, these additional requirements will have some effect on the operation of mobile units as well. A careful review of this chapter is therefore required of all terminal designers and manufacturers.

Since the addendum document was printed, several changes have been made to the protocol. They will be included in a future revision of the ERTEL - provided specification. These changes, which should be applied to the MTS 15.1 document immediately following, are detailed below so that this very important new information can be brought to the attention of interested parties in a timely manner.

1. Section 3.5, page 8: the first paragraph should be changed to read:

If the terminal has lost consecutive <SVP6> signals over a period less than 60 seconds, it should remain in the operating state to synchronize again. If the terminal has not succeeded in synchronizing within 60 seconds, it should initiate the roaming procedure.

2. Section 3.6, page 12: the two paragraphs under the heading "Evaluation of other base stations" should be changed to read:

The evaluation of base stations on the CURRENT-SYSTEM-CHANNEL should be based on the average received signal strength over a time period indicated in <SVP6> (default value, 60 seconds).

The integration time for evaluating base stations on other channels is indicated in <SVP6> (default value, 3 RSSI-PERIODS).

3. Section 3.8.1, page 13: the second paragraph under the heading "UP LINK TRAFFIC" should be changed to read:

For uplink traffic the terminal should enter the OPERATING state and then follow the normal access rules, i.e., wait for a <FRI> signal and then choose a random slot in which to transmit.

4. Section 3.10, page 17: This section deals with voice operation and may be disregarded.

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5. Section 4, pages 25 and 28: Note that the <SVP5> and <SVP6> may contain up to 186 MANs each. A parameter will be added in the currently unused portion of the primary block of <SVP5> and <SVP6> to indicate the number of MANs in the mail list or traffic list, respectively.

6. Section 4, pages 28 and 29: parameters will be added in the currently unused portion of the primary block of <SVP6> to indicate signal strength evaluation times for the CURRENT-SYSTEM-CHANNEL (default 60 seconds) and other channels (default 3 RSSI-PERIODS). (See item 2. above).

7. Section 4, page 29: the entry for "TRANSACTION-TIME" should be changes to read:

States the time the terminal should stay in OPERATING state after (1) reception of a message from the network, and (2) transmission of a message to the network. (0-255) X 250 ms. Default value: 40 (10 seconds). TRANSACTION-TIME starts after transmitting or receiving an <ACK>, respectively.

8. Section 6, pages 35 and 36: the following three items listed as design recommendations have been changed to design requirements, and their functionality must be included in portable units:

Automatic change to mobile terminal operation (page 35)

User notification of 'lost contact' (page 36)

Display RSSI to user before transmitting (page 36)

The remaining three items - manual selection of operating mode, prevention from automatic quick channel monitoring, and manual initiation of channel monitoring - continue to be design recommendations.

ADDITIONAL INFORMATION

In the "INFO" MPAK (See MTS 09A.2, pages 107 and 108), portable terminals will be defined as terminal type number 4. The INFO MPAK will also now include a parameter indicating the operating mode of the portable unit (mode = mobile terminal mode; mode 1 = battery saving mode).

In the MASC interface (see MTS 19A.2), new commands will be added to accommodate portable terminals. Details will be provided later.

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ABSTRACT

This document specifies additional requirements for handheld portable terminals to be connected to the MOBITELEX system.

An interface for hand-held portable terminals, where power conservation is one prime objective, is defined.

This document should be considered as an ADDENDUM to the MOBITEK Terminal Specification (MTS) for 8 kbps mobile terminals, LZBA 703 1001, R1A.

Doc No	1056 - A 296 6084 Ue
Docum Date	90-05-11
Rev	PA3
Rev Date	MTS15.1

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1056 - A 296 6084 Ue	
Doc. No. 90-05-11	Rev. PA3
MTS15.1	

1 INTRODUCTION

This document specifies additional requirements for hand-held portable terminals to be connected to the MOBITECH system.

It should be considered as an ADDENDUM to the complete MOBITECH Terminal Specification for 8 kbps mobile terminals, LZBA 703 1001, RLA.

If certain requirements are made for hand-held portables these are made in this document. It could either be new additional requirements or new requirements that replaces ones that are made in the specification for ordinary mobile terminals.

2 GENERAL DESCRIPTION

A hand-held portable terminal is basically a mobile terminal and should therefore conform to the requirements for mobile terminals, but with the additional ability to go into low power drain operating mode and wake up when required to receive messages from the network.

When the hand-held has received its messages it goes asleep again.

One limitation for portables in this mode is that messages to these terminals may be delayed during the time when the portable is asleep.

Whenever a hand-held wants to send a message it immediately wakes up, waits for a free-signal and sends the message. The terminal then stays awake for a period of time in order to be able to receive a quick message response.

The roaming procedure is essentially the same as for ordinary mobiles, but is controlled from separate sweep-parameters for hand-held terminals. The hand-held terminals performs the base evaluation during its awake time.

Richard

Reprod

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3 OPERATING PRINCIPLES

3.1 START UP PROCEDURE

When the portable is powered up for the first time and/or when it has lost synchronization with the network or lost important information/parameters, it should consider itself to be in normal mobile terminal mode and act according to that.

When the hand-held has found a system channel on a base station to use, received the relevant parameters from the base and synchronized to it, the terminal should send MPAK ROAM or ACTIVE according to the roaming procedure.

The hand-held always has the possibility to go to normal mobile terminal mode, e.g. when the terminal is put in a power charger or for a major data transaction session when you want to be active all the time. In order to inform the network of this change of mode, the hand-held sends a new MPAK called MODE.

3.2 STATES

There are two different states that a hand-held terminal could enter when it is in the low power drain mode; STANDBY state or OPERATING state.

The STANDBY state should be considered as a 'sleeping' mode where only time keeping functions for synchronizing the terminal to the base station are in operation.

In the OPERATING state the terminal should be considered as fully operational.

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3.3 TRAFFIC LIST

The hand-held terminal is notified in a TRAFFIC LIST that traffic will sent to the terminal.

The TRAFFIC LIST contains the TERMINAL-MAN or the GROUP-MAN of those terminals that should remain in the OPERATING state in order to be available for the down-link traffic from network.

The TRAFFIC LIST is part of a new <SVP>-frame of SUBTYPE 6, denoted <SVP6>-frame.

Terminals not included in the TRAFFIC LIST may directly go back to STANDBY state in order to save battery.

3.4 MAIL LIST

Messages not acknowledged by the terminal may be stored in the network mailbox according to the conditions describes in R1-09, 8kbps MTS.

In order to inform terminals that have messages in the network mailbox, the MAIL LIST is introduced.

The MAIL LIST contains a list of those terminal MAN having messages in the mailbox. The MAIL LIST is within the <SVP>-frame of subtype 5, denoted <SVP5>.

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3.5 SYNCHRONIZATION TO THE NETWORK

Hand-held terminals using the this battery saving protocol cyclically goes from the STANDBY state to the OPERATING state.

The terminal must be synchronized to the <SVP6> (TRAFFIC LIST) sent from the network. The <SVP6> frame is sent periodically from the network on the system channels where hand-held terminals can operate and use the battery saving protocol.

The <SVP6> also contains the parameter TIME-TO-NEXT indicating the remaining period of time from this <SVP6> to the next time the terminal should enter the OPERATING state.

TIME-TO-NEXT = time from first bit (bit 1) in the framehead of the received <SVP6> to the next time the terminal should enter the OPERATING stage.

The <SVP6> also contains the parameter CYCLE-TIME which is the nominal cycle time between the start of two operating states.

The length of the CYCLE-TIME parameter is a compromise between response-time requirements and power consumption requirements of the terminal.

Normally the terminal uses the TIME-TO-NEXT parameter in the <SVP6> to synchronize to the next time to enter the OPERATING state. If one or more of the <SVP6> frames are lost, the terminal should use the CYCLE-TIME parameter in order not to lose synchronization.

Once the terminal has entered the OPERATING state it remains in this state until it receives an <SVP6> frame with a TRAFFIC LIST where the terminal is not included. The <SVP6> is terminating the transmission of the sweep frames.

If the network is going to send other sweep frames when the terminals are in the OPERATING state, they will be sent prior the <SVP6> frame.

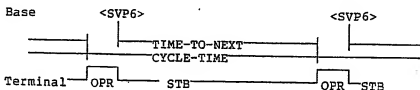
If none of the <SVP3> to <SVP6> has been received within 2 seconds from the transition to the OPERATING state, the terminal could return to STANDBY.

After the reception of every <SVP3> to <SVP5> the terminal stays in OPERATING state for another 2 seconds or till it receives an <SVP6>.

If the hand-held consider itself as having lost synchronization to the network, e.g. lost of a number of consecutive <SVP6>, it should stay in OPERATING state to synchronize again.

Example 1 :

Terminal uses TIME-TO-NEXT for synchronizing.

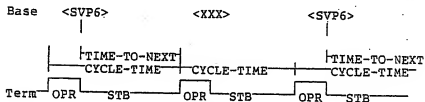


OPR = terminal in OPERATING state

STB = terminal in STANDBY state

Example 2:

Terminal is using the CYCLE-TIME when <SVP6> is lost to keep synchronization.

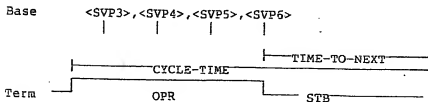


OPR = terminal in OPERATING state

STB = terminal in STANDBY state

Example 3:

Multiple sweep frame could be sent during the OPERATING state.

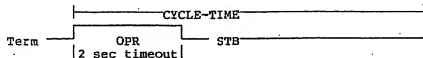


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Example 4 :

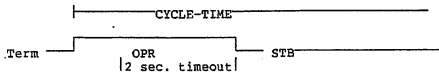
Terminal does not receive any sweep frame within 2 seconds from the start of the OPERATING state and returns to STANDBY.

Base

Example 5:

The terminal receives a <SVP3> but the <SVP6> is not received so the OPERATING state is terminated by the 2 second timeout. The timeout is counted from the reception of the <SVP3> frame.

Base <SVP3>



Start
End
Repeat

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3.6 ROAMING

The roaming procedure for hand-held terminals follows basically the roaming procedure for mobile terminals described in RI-16.

Since a hand-held terminal is most of the time in the STANDBY state, the normal monitoring of the roaming procedure must be carried out during the time when the terminal is in the OPERATING state. During the OPERATING state the terminal measures the averaged received signal strength and calculates a roaming value.

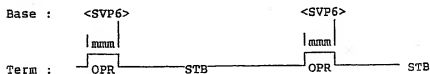
The system parameters controlling the roaming procedure for hand-held portables are defined in the <SVP3>-frame. This gives the possibility to have different parameters for mobile terminals (defined in the <SVP1> frame) and for hand-held portables.

In order to control the performance of the terminals roaming procedure, different roaming parameters can be set in the <SVP3>-frame from the network. Here are some examples described and the impacts on the terminals performance.

Example 1:

If SCAN TIME = 0 the terminal only monitors the CURRENT_SYSTEM_CHANNEL during the OPERATING state.

At evaluation, if the roaming value < BAD_BASE the terminal goes to the 'quick channel monitoring' procedure since no other channels has been detected.



m = monitor CURRENT SYSTEM CHANNEL
OPR = terminal in OPERATING state
STB = terminal in STANDBY state

The other sweep frames are not shown in this figure but are coming before the <SVP6> frame if they are sent out.

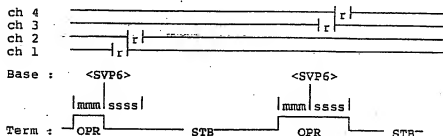
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Example 2 :

If SCAN TIME = 1 ... 255, the terminal monitors other channels according to the channel list information the mobile has derived in the <SVP3> or from the default list.

The start of the scan period is only critical in that sense that the terminal must not leave the system channel and monitor another channel when it should be in OPERATING state.

The terminal should not leave CURRENT_SYSTEM_CHANNEL and monitor other channels during the sweep cycle if it is addressed in the TRAFFIC LIST.



m = monitor CURRENT_SYSTEM_CHANNEL
 s = scan other system channels
 r = RSSI PERIOD
 OPR = terminal in OPERATING state
 STB = terminal in STANDBY state

Please see the chapter ROAMING in RI-16 for further information.

E-Gen:

E-Gen:

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Criteria for leaving base :

The same criteria for leaving the CURRENT BASE applies for a hand-held terminal as the mobile terminal but with the parameters in the <SVP3> frame. The fifth criteria (item -5-) is not valid for hand-held terminals.

Please see the chapter ROAMING in RI-16 for further information.

Evaluation of other base stations :

The evaluation of base stations on the CURRENT SYSTEM-CHANNEL, should be based on the averaged received signal strength from at least 60 seconds or some other suitable integration time.

When evaluating other channels than the CURRENT SYSTEM CHANNEL, roaming-values from at least three (3) RSSI_PERIODS should be averaged.

Quick channel monitoring :

In quick channel monitoring when the SCAN TIME = 0 and when the terminal has found a channel with a roaming value > GOOD_BASE, the terminal should remain on the channel for at least 5 seconds during the measuring of received signal strength. Please refer to 'quick channel monitoring' part (item -4-) of the ROAMING chapter in RI-16.

At Power On

When the hand-held terminal is switched on it should use the stored CURRENT_SYSTEM_CHANNEL and the CURRENT_BASE.

If there is no CURRENT_BASE stored the terminal directly starts the quick channel monitoring procedure using the default list of system channels. When a CURRENT_SYSTEM_CHANNEL and a CURRENT_BASE has been found and the MPAA ROAM has been sent to the network, the terminal synchronizes to the <SVP6>-frames.

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3.7 FLEET DIVISION OF HAND-HELD PORTABLES

In order to assign a certain system channel (and/or access channel) to hand-held terminals or parts of the fleet of the hand-held terminals a <SVP>-frame of SUBTYPE 4 is introduced, denoted <SVP4>-frame. The <SVP4>-frame should be interpreted in same way as the <SVP2>-frame for mobile terminals, described in 8kbps MTS section R1-16.

3.8 MESSAGE TRANSACTIONS

3.8.1 UP LINK TRAFFIC

The access requirements for up-link traffic from a hand-held terminal are basically the same as for a mobile terminal.

A hand-held terminal that is going to transmit a message to the network enters the OPERATING state directly and waits for a valid <PRI>-frame from the network according to the 8kbps MTS.

When the terminal makes an access request for data using the <ABD>-frame, the terminal should follow the 8kbps MTS dialogues and remain in OPERATING state till the <NRM>-frame is transferred successfully or when the dialogue terminates for any reason.

After the message is successfully transferred to the network the hand-held terminal remains in OPERATING state for TRANSACTION-TIME, defined in <SVP6>, before it goes back to STANDBY state. This gives a possibility for transferring an answer back to the hand-held without any delays caused by the waiting time to the next TRAFFIC LIST transmission. This function could be considered as if a 'logical down-link channel' has been opened to the terminal for TRANSACTION-TIME.

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Hand-held terminals having down-link traffic is addressed in the TRAFFIC LIST.

When the hand-held terminal receives a TRAFFIC LIST that contains one of its terminal addresses (TERMINAL MAN or GROUP MAN) it stays in OPERATING state and awaits one message.

When the message is successfully received the terminal stays in OPERATING state for TRANSACTION-TIME in order to be able to receive more down-link messages coming from the network. The parameter TRANSACTION-TIME is included in the <SV6>-frame, and is the same as for up-link traffic.

If no message has been received within the TRANSACTION-TIME elapsed from the reception of the last message, the terminal can leave OPERATING state.

The terminal can also leave OPERATING state when it receives a TRAFFIC LIST without any of the terminal addressees.

When a hand-held terminal is ordered to another channel for down-link data transmission, <BKD> frame from network, the hand-held terminal should remain in the OPERATING state until the data transmission dialogue is completed according to the 8kbps MTS.

Terminals not included in the TRAFFIC LIST may directly go to STANDBY state in order to save battery.

Terminal is not in traffic list

Base : <SVP6> <SVP6>
 | |

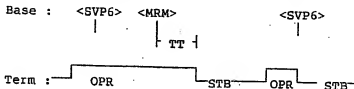
Term : OPR STB OPR STB

OPR = terminal in OPERATING state
STB = terminal in STANDBY state

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Date Recd
90-05-11Fax
PA3In Reply
MTS15.1Example 2:

Terminal is in traffic list of <SVP6> and the network has one <MRM> to transmit.



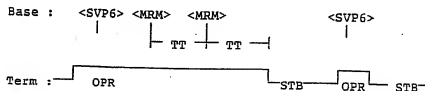
TT = TRANSACTION-TIME

OPR = terminal in OPERATING state

STB = terminal in STANDBY state

Example 3:

Terminal is in traffic list of <SVP6> and the network transmits multiple <MRM> within the sweep cycle.



TT = TRANSACTION-TIME

OPR = terminal in OPERATING state

STB = terminal in STANDBY state

100kms

Legend

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The hand-held terminal use of the ACTIVE/INACTIVE packet has been modified to better suit their environment and application.

Hand-held portables used in-doors will lose contact with the network much more frequently than mobile terminals. Hand-held terminals should therefore not send ACTIVE due to 'lost contact' according to the roaming procedure since this will cause considerable system signalling overhead.

Hand-held terminals should send INACTIVE / ACTIVE when switched-off and switched-on respectively.

When a hand-held terminal is addressed in the MAIL LIST it has the possibility to empty the mailbox by sending an ACTIVE packet.

Terminal is in mail list of <SVP5> and the network has one or more <MRM> placed in mailbox.

Base : <SVP5> | <ACK> | <MRM2> | <SVP6>

Term : <MRM1> | TT + TT |

OPR STB OPR STB

```

TT = TRANSACTION-TIME
OPR = terminal in OPERATING state
STB = terminal in STANDBY state
MRM1 = MPAK ACTIVE
MRM2 = any MPAK from mailbox

```

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3.10 LINE CONNECTION

Call set-up and disconnection procedures for line connection to a hand-held terminal follows the requirements in the 8kbps MTS.

When a hand-held terminal is called from the network for a line connection, the terminal is addressed in the TRAFFIC LIST with the TERMINAL MAN or one of the GROUP MAN. The terminal remains in the OPERATING state and follows the normal procedure for call set-up described in the 8kbps MTS. The terminal can leave the OPERATING state when the call is disconnected, according to the dialogues in the 8kbps MTS.

When a hand-held terminal initiates a call set-up for a line connection, the terminal enters OPERATING state before sending the line connection request, and stays in this state until the call is disconnected, according to the 8kbps MTS.

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4 ADDITIONAL FRAMES - DATA LINK LAYER

FRAME TYPE <SVP>, Sweep signal

APPLICATION The sweep signal is a periodically recurring signal from BASE. An <SVP> is transmitted by BASE for two reasons:

- 1) <SVP> marks the start of a sweep cycle.
- 2) <SVP> contains system parameters.

<SVP> has 2 different subtypes for mobile terminals and 4 subtypes for hand-held portable terminals :

SUBTYPE

- 1 states the values of system parameters for mobile terminals
- 2 states the frequency of different channel types for mobile terminals
- 3 subtype only for hand-held terminals using the battery saving protocol described in this document. This subtype contains the system parameters for the hand-held terminals.
- 4 states the frequency of different channel types for hand-held terminals.
- 5 includes the MAIL LIST for terminals (may be used both by mobile terminals and hand-held terminals)
- 6 includes the TRAFFIC LIST and the timing parameters for hand-held terminals

Note 1: <SVP> of subtype 1 and 2 are not described in this Addendum. Please refer to 8kbps MTS R1-16.

Note 2: For <SVP5> and <SVP6>, the hand-held should use correctly received following blocks, even though the whole frame may not be correct.

Broadcast
 Report

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<SVP>, SUBTYPE 3

- states the values of system parameters for hand-held terminals.

PRIMARY BLOCK

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		90-05-11	PA3 MTS15.1
SVPTYP	States the <SVP> subtype, value 00000011 in this case.		
TXPOW	States the decrease in output power (0-255 dB below nominal level) to be used by the hand-held terminal. The default value of 0 is used until this signal is received.		
RSSI_PROC	States the method of the signal strength measurement: 0 = FRAME 1 = CONTINUOUS The default value is FRAME.		
RSSI_PERIOD	Time used by the roaming algorithm (0-255 *20 ms). Default value: 148 (2 960 ms).		
MAX_REP	States the value of the variable Max_rep.		
BASEST	States status of base station.		
SCAN_TIME	States the length of a period (0-255 *100 ms) when the hand-held terminal scans other system channels. Default value: 30 (3 seconds).		
BAD_BASE	Used by the roaming algorithm. 0-255 dBuV. Default value: 15.		
GOOD_BASE	Used by the roaming algorithm. 0-255 dBuV. Default value: 15.		
BETTER_BASE	Used by the roaming algorithm. 0-255 dB. Default value: 10.		

B.000

A.000

A 2915:533

1056 - A 296 6084 Ue

Date Recd	File	F. F. #
90-05-11	PA3	MTS15.1

FOLLOWING BLOCKS

If any, they contain a list of system channels to be used in base station monitoring. A frame with a list containing new system channels completely overrides the previous frame. The channel list has the following format (as described in the MAIN DOCUMENT):

FOLLOWING BLOCK #1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
number of channels									0	0	0	0	0	0	0

17								32	33						48
channel #1 - UPFREQ								channel #1 - DOFREQ							

49								64	65						80
channel #2 - UPFREQ								channel #2 - DOFREQ							

81								96	97						112
channel #3 - UPFREQ								channel #3 - DOFREQ							

113								128	129						144
channel #4 - UPFREQ								channel #4 - DOFREQ							

145															160
PARITY															

The number of following blocks depends on the size of the list. The maximum number of channels in the list is stated in reference R1-06.

Continues with following block #2 on the next page.

Bldg.

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A 702 41333

1056 - A 296 6084 Ue	
90-05-11	PA3 MTS15.1

FOLLOWING BLOCK #2

01	16 17	32
channel #5 - UPFREQ	channel #5 - DOFREQ	
33	48 49	64
channel #6 - UPFREQ	channel #6 - DOFREQ	
.	.	.
129	144 145	160
channel #9 - UPFREQ	PARITY	

FOLLOWING BLOCK #3

01	16 17	32
channel #9 - DOFREQ	channel #10 - UPFREQ	
33	48 49	64
channel #10 - DOFREQ	channel #11 - UPFREQ	

etc.

Boltorn:

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A 292 615813

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		P. 1 MTS15.1	

<SVP>, SUBTYPE 4 - states the frequency of different channel types for hand-held terminals.

PRIMARY BLOCK

01 02 03			22 23 24			25 26 27			28 29 30			31 32		
MOB						0 0 0			0 1 1			1 1		

33 34 35			36 37 38			39 40 41			42 43 44			45 46 47			48		
PRIO			MASK			BLOCK											

49 50 51			52 53 54			55 56 57			58 59 60			61 62 63			64		
SVPTYP						CHATYP											

65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80															
UPFREQ															

81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96															
DOFREQ															

97 98 99 100																144			
0 0 0 0 0 0																0 0 0 0 0 0			

145																160			
PARITY																			

304kart

 Exprod

A 295 51530

		1056 - A 296 6084 Ue	
Date Recd		Iss	Ref
90-05-11		PA3	MTS15.1

SVPTYP States the <SVP> subtype, value 00000100 in this case.

CHTYP States the type of channel:
Value:
 1 Local system channel opened
 2 Not used (ignore that order)
 3 Local system channel closed (return to previous system channel)
 4 Access channel opened
 5 Access channel closed

UPFREQ Frequency number for up frequency, i.e. the frequency on which the terminal transmits.

DOFREQ Frequency number for down frequency, i.e. the frequency on which BASE transmits.

FOLLOWING BLOCK -- No following blocks in this type of frame.

1-Subtype

2-Channel

3-Frame

A 296 3153.3

- contains a list of terminal MAN that has messages stored in the network mailbox

[illegible]

States the <SVP> subtype, value 00000101 in this case.

1056 - A 296 6084 Ue		
Docum. Date 90-05-11	Doc PA3	PG. E.A. MTS15.1

FOLLOWING BLOCKS

Containing a list of terminal
MAN that has been stored in the
network mailbox.

FOLLOWING BLOCK #1

01			24
MAN 1			
25			48
MAN 2			
49			72
MAN 3			
73			96
MAN 4			
97			120
MAN 5			
121			144
MAN 6			
145			160
PARITY			

The number of following blocks depends on the size of the list.

Continues with following block #2 on the next page.

Block:

Repeat:

A 296 61334

1056 - A 296 6084 Ue		
90-05-11	PA3	MTS15.1

FOLLOWING BLOCK #2

01		24
MAN 7		
25		48
MAN 8		
49		72
MAN 9		
73		96
MAN 10		
97		120
MAN 11		
121		144
MAN 12		
145		160
PARITY		

etc.

Block:

Repeat:

A 296 6084 Ue

1056 - A 296 6084 Ue

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90-05-11

PA3

MTS15.1

<SVP>, SUBTYPE 6

- contains the timing parameters used in synchronization and message transactions

PRIMARY BLOCK

01	02	03		22	23	24	25	26	27	28	29	30	31	32
MOB							0	0	0	0	1	1	1	1

33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
PRIO			MASK				BLOCK								

49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
SVPTYP								CYCLE-TIME							

65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
TIME-TO-NEXT								TRANSACTION-TIME							

[illegible][illegible][illegible]

145 160

PARITY

Bridges

Accepted

1056 - A 296 6084 Ue	
Source State	1200
90-05-11	PA3
MTS15.1	

SVPTYP	States the <SVP> subtype, value 00000110 in this case.
CYCLE-TIME	States the cycle time between two OPERATING states (0-255 x 250 ms).
TIME-TO-NEXT	States the time to the next <SVP6> frame (0-255 x 250 ms).
TRANSACTION-TIME	States the time the terminal should stay in OPERATING state after 1) reception of a message from the network and 2) transmission of a message to the network (0-255 x 250 ms). Default value: 80 (20 seconds).

Print

Report

1056 - A 296 6084 Ue		
Serial Date	Line	#. PA
90-05-11	PA3	WTS15.1

FOLLOWING BLOCKS

Containing a list of terminal
MAN or group MAN that are going
have down-link traffic during
this sweep cycle.

FOLLOWING BLOCK #1

01	-----	24
MAN 1		
25	-----	48
MAN 2		
49	-----	72
MAN 3		
73	-----	96
MAN 4		
97	-----	120
MAN 5		
121	-----	144
MAN 6		
145	-----	160
PARITY		

The number of following blocks depends on the size of the list.

Continues with following block #2 on the next page.

Block:

Segment

A 292 4153d

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FOLLOWING BLOCK #2

01		24
MAN 7		

25		48
MAN 8		

49		72
MAN 9		

73		96
MAN 10		

97		120
MAN 11		

121		144
MAN 12		

145		160
PARITY		

etc.

B-100001

B-100001

A 296 6084 Ue

No. 1056 - A 296 6084 Ue	
Date: 90-05-11	Rev: PA3
F. 1.1 MTS15.1	

5 ADDITIONAL MPAK - NETWORK LAYER

A new MPAK is included for terminals using the battery saving protocol. The MPAK is used to inform the network that the terminal has changed from battery saving mode to operate as a normal mobile terminal and vice versa.

The new MPAK is within the packet class DTESERV (3) and has the packet type = 24.

MODE (mode information):

Designated sender:

The hand-held portable terminal.

Designated addressee:

The network.

Raised flags:

No raised flags.

Criteria for generating the packet:

When hand-held portable terminal changes from the battery saving protocol to operate as a mobile terminal this packet is used to inform the network.

The same packet is sent to the network, but with a different mode identifier, when the terminal enters the battery saving protocol from being operating as a mobile terminal.

Dr. Gert

Reprint

No. 1056 - A 296 6084 Ge	
Date Recd. 90-05-11	P. From PA3 MTS15.1

The network's normal action when receiving the packet:

The network registers how the terminal operates, and forwards down-link traffic to the terminal in accordance to this. If terminal is using the battery saving protocol, the terminal is addressed in the TRAFFIC LIST.

If the terminal is operating as a mobile terminal the network sends traffic immediately to the terminal.

The terminal's normal action when receiving the packet:

The terminal does not normally receives this packet.

Length of the packet:
9 octets.

Bureau

Regard

A 292 61 12.3

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MODE as generated by the terminal:

MPAK-COMMON COMPONENT:

octet 1-3:

sender: the terminal

octet 4-6:

addressee : the Mobitex Network

octet 7:

0 0 0 0 0 0 0 0

octet 8:

1 1 0 1 1 0 0 0

TYPE DEPENDENT COMPONENT:

octet 9 :

mode identifier

mode identifier :

0 = mobile terminal operation

1 = battery saving protocol operation

2-255 = reserved

B02001

Eapred

A 292 51534

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Rev: PA3

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User notification of 'lost contact'

When the terminal loses contact with network, according to roaming procedure, and goes into quick scan monitoring the operator of terminal should be notified. It is also suitable if the received signal strength indication (RSSI) is displayed to the user so positioning of the terminal could be facilitated.

RSSI when transmitting

It is recommended to display the received signal strength to the user especially when the terminal is going to transmit, so the user can move the terminal to a good location.

Baker:

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Docum Date	Rev	Doc
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7 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 21
RI-09, 6
RI-16, 10, 11, 12, 13, 18

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
RI-01	Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

Revert

Legend

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Dokumen/Gesetz - Document-approved ET/SYSC-STT <i>STT</i>		Datum, Date 1990-02-26 A
		Pl. Pl. MTS16.2
Bemerkung		Titel MOBITEX Data Link Layer, Mobile Terminal 8/16 kbps

Cantel Mobitex

ABSTRACT

This document specifies the data link layer for terminals connected to the MOBITEX network.

The mobile terminal's Data Link Layer together with the Physical Layer form a radio protocol for communication between mobile stations (MOB) and a base radio station (BASE).

The interchange of information between BASE and MOB is in the form of frames. There are 21 different types of frames.

A number of different access strategies are used in the protocol to permit the handling of a large number of mobile terminals on a few trunked channels. The most important aspects are:

- Time slots
- Selective repetition
- Priority access
- Concurrent channels
- Automatic roaming.

To achieve high transmission reliability, the frames are divided into blocks where each block is coded.

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1 INTRODUCTION

1.1 GENERAL

The Link Layer of mobile terminals forms a link between the Network Layer and the physical radio channel with its special properties. It ensures a safe and efficient transmission path between the mobile terminal and the network, represented by the base stations. The Link Layer includes error correction facilities, access algorithms, roaming algorithms, priority facilities etc.

Bildtext

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2 INTERACTION WITH UPPER LAYERS

The upper layers handle packets of information, MPAK. The following figure presents the general appearance of an MPAK (it is fully described in reference R1-09).

Sender
Addressee
Type, status etc.
Type-dependent component

The Link Layer transmits the MPAK in the form of a frame. The frame structure is defined in chapter FRAME STRUCTURE. The conversion of a packet into a frame is described in APPENDIX A.

If the Link Layer is unsuccessful in transferring an MPAK to the network, it is returned to the Network Layer with this information. The Network Layer can then request a new attempt by sending the MPAK back to the Link Layer.

Blockout

Regres

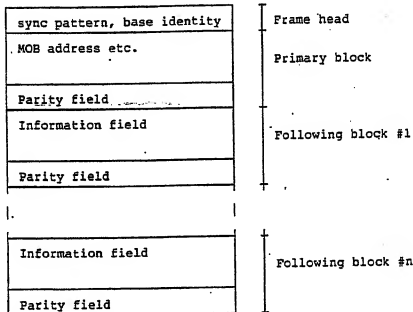
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3 FRAME STRUCTURE

3.1 PARTS OF THE FRAME

The transmission of digital information over the radio channel is performed by transmitting frames. A frame comprises a limited number of bits which are transmitted in an uninterrupted sequence. The frame consists of the following parts:



The frame head is described in detail in reference R1-17. The information and parity fields of the following blocks are described in APPENDIX A, together with the primary block.

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3.2 FRAME TYPES

There are 21 different frame types:

	<u>Name</u>	<u>Designation</u>	<u>Transmitted by</u>	
			<u>BASE</u>	<u>MOB</u>
1	M frame	<MRM>	Yes	Yes
2	Acknowledgement	<ACK>	Yes	Yes
3	Negative acknowledgement	<NAK>	Yes	Yes
4	Repetition request	<REB>	Yes	Yes
5	Repetition reply	<RES>	Yes	Yes
6	Access request, data	<ARD>	No	Yes
7	Access request, speech	<AET>	No	Yes
8	Access request, emergency	<ABL>	No	Yes
9	Access permission, data	<ATD>	Yes	No
10	Access permission, speech	<ATT>	Yes	No
11	Access permission, emergency	<ATL>	Yes	No
12	Change channel, data	<BKD>	Yes	No
13	Change channel, speech	<BKT>	Yes	No
14	Free signal	<PRI>	Yes	No
15	Sweep signal	<SVP>	Yes	No
16	Silence order	<TST>	Yes	No
17	Activity request	<AKT>	Yes	No
18	No access permission, speech	<NAT>	Yes	No
19	Change base station, speech	<BET>	Yes	No
20	Wait for channel, speech	<VKT>	Yes	No
21	Cancel access request, speech	<AAT>	No	Yes

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The following pages give a brief description of each frame type. Refer to Appendix A "Frames" for a complete definition of frame types.

1 M-frame

<MRM>

An <MRM> is used to transfer packets (MPAKs). The packet formats are defined in reference R1-09.

2 Acknowledgement

<ACK>

An <ACK> acknowledges a correctly received frame.

<ACK> indicates that all blocks in the frame have been correctly received. It includes the sequential number of the received frame.

3 Negative acknowledgement

<NAK>

A <NAK> requests repetition of the entire <MRM>.

<NAK> indicates that the primary block has been correctly received, but that the following blocks have been lost. It contains the sequential number of the received primary block. <NAK> results in a complete repetition of the lost <MRM>.

Note that if the number of blocks in <MRM> was 3 or more, <REB> is used instead of <NAK>.

4 Repetition request

<REB>

A <REB> requests repetition of erroneous blocks in an <MRM> or <RES>.

If it is found during reception that certain blocks in a frame are not correct, a request for these blocks to be repeated can be made by transmitting a <REB>. The request contains a bit map of the blocks to be repeated. This bit map refers to the original <MRM>, even during a sequence of repetitions.

<REB> contains the sequential number of the received <MRM> and results in a <RES>.

Note that if the number of blocks in <MRM> was 2 or less, <NAK> is used instead of <REB>.

Buildout

Export

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F. P.	MTS16.2	

5 Repetition reply <RES>

A <RES> is the reply to a <REB>.

<RES> is a selective repetition of blocks from an <MRM>. The following blocks of the <RES> contain copies of blocks according to the bit map of the <REB>. <RES> contains the sequential number of the original <MRM>.

6 Access request, data <ABD>

An <ABD> is a request to transmit an <MRM>, containing "data" (defined in chapter "Addressing a mobile terminal"), whose length (number of blocks) exceeds the value of MAX_ACCESS. MAX_ACCESS is described in chapter "Time division".

If the length of the <MRM> exceeds MAX_ACCESS, access must be requested before the <MRM> may be sent.

The <ABD> states the number of blocks in the corresponding <MRM>.

7 Access request, speech <ABT>

An <ABT> is a request to transmit an <MRM>, containing "speech" (defined in chapter "Addressing a mobile terminal"), containing a request for a line connection whose length (number of blocks) exceeds the value of MAX_SPEECH. MAX_SPEECH is described in chapter "Time division".

If the length of an <MRM> with a connection request exceeds MAX_SPEECH, access must be requested before the <MRM> may be sent.

The <ABT> states the number of blocks in the corresponding <MRM>.

Belkom:

Reproes

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8 Access request, emergency <ABL>

An <ABL> is a request to transmit an <MRM> containing an "emergency" (defined in chapter "Addressing a mobile terminal"), whose length exceeds the value of MAX ACCESS. MAX ACCESS is described in chapter "Time division".

If the length of the <MRM> exceeds MAX ACCESS, access must be requested before the <MRM> may be sent.

The <ABL> states the number of blocks in the corresponding <MRM>.

9 Access permission, data <ATD>

BASE replies with an <ATD> to an <ABD> from a MOB, when BASE is ready to accept an <MRM>.

When permission is granted (<ATD> received), MOB is expected to transmit an <MRM> containing a data packet.

10 Access permission, speech <ATT>

BASE replies with an <ATT> to an <ABT> from a MOB, when BASE is ready to accept an <MRM>.

When permission is granted (<ATT> received), MOB is expected to transmit an <MRM> containing a request for line connection.

11 Access permission, emergency <ATL>

BASE replies with an <ATL> to an <ABL> from a MOB, when BASE is ready to accept an <MRM>.

When permission is granted (<ATL> received), MOB is expected to transmit an <MRM> containing an emergency signal.

Block:

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A 292 5153-3

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12 Change channel, data <BKD>

A <BKD> orders a MOB to another channel in order to transmit or receive an <MRM>, data or emergency.

Normally the terminal returns to the original channel when the <MRM> has been transmitted or received. If an error occurs on the assigned channel then MOB returns to the original channel after a timeout period stated in the <BKD>.

13 Change channel, speech <BKT>

A <BKT> orders a MOB to another channel in order to transmit or receive an <MRM> containing a request for line connection.

Normally the terminal returns to the original channel when the line connection is over. If an error occurs on the assigned channel then MOB returns to the original channel after a timeout period stated in the <BKT>.

14 Free signal <FRI>

BASE transmits a <FRI> when it is ready to handle traffic from MOB.

A free signal precedes a free cycle. A free cycle is a period of time when all of, or parts of, the total fleet of mobile terminals are collectively permitted to transmit.

15 Sweep signal <SVP>

The sweep signal is a periodically recurring signal from BASE. An <SVP> is transmitted by BASE for two reasons:

- 1 <SVP> marks the start of a sweep cycle.
- 2 <SVP> contains system parameters, such as:
 - time to next <SVP>
 - maximum number of repetitions
 - channel list
 - local system channel
 - access channel

Revised

Revised

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16 Silence order <TST>

Silence order is used by BASE to withdraw all access permissions during a free cycle. A MOB that is already transmitting may continue to do so, but for every other MOB the access permissions for all traffic types (emergency, speech and data) are withdrawn.

Note: Please also refer to the description of the silence signal in reference RL-17. This signal has the same meaning as the <TST>-frame but uses only the frame head and thus addresses ALL mobile terminals.

17 Activity request <AKT>

An <AKT> is used by BASE to check whether a certain MOB is active. MOB replies with an <ACK> to such a frame.

18 No access permission, speech <NAT>

BASE replies with <NAT> to an <ABT> from a MOB when, for some reason, a line connection cannot be set up (e.g. no channel is available).

19 Change base station, speech <BBT>

BASE will use <BBT>

- as a response to an <ABT> when another base station is to be used for the line connection
- or
- to hand over a call in progress to another base station.

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20 Wait for channel, speech

<VKT>

If no channel is immediately available, BASE may place MOB in a queue of waiting calls and reply with a <VKT> to a received <ABT>. When a speech channel becomes available, BASE indicates this by transmitting a <BKT> to MOB. If there is no free channel within reasonable time, BASE ends the session by transmitting a <NAT>.

21 Cancel access request, speech

<AAT>

After having received a <VKT> from BASE, the mobile terminal may end the session by transmitting an <AAT>.

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4 TRAFFIC HANDLING

4.1 TRANSMISSION PRINCIPLES

Transmission is carried out through the interchange of frames between MOB and BASE. Different types of transmission cases demand different behaviours by the units involved. Some of the problems considered in this chapter are:

- Access to the channel - describes how a small number of channels can handle concurrent traffic from a large number of subscriptions at the same time.
- Keeping contact with the network - describes how the mobile unit maintains its contact with the network (roaming).
- Addressing - describes how the addressing of base radio stations, terminals and subscriptions take place.
- Sequential numbering - describes how repeated presentations of repeated frames are avoided.

Revisions

Revisions

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4.2 ACCESS TO THE CHANNEL

4.2.1 Time division

A MOB, with traffic to send, is allowed to establish contact with the base radio station in special free cycles. These cycles are initiated by BASE by transmitting a <PRI>.

This frame contains an indication of the length of the free cycle, including the following parameters:

Slot_length States the length of each individual free slot.

Free_slots States the total number of free slots in the current free cycle.

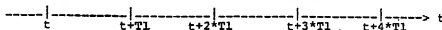
Rand_slots States the interval for the random number generator in the MOB.

Max_access States the maximum length of an <MRM>-frame, containing data or emergency, which can be sent without a preceding access request.

Max_speech States the maximum length of a frame, containing a connection request, which can be sent without a preceding access request.

In order to reduce the probability of a collision between traffic from several mobile units, the free cycle is subdivided into slots. The length of these slots (T_1) are stated by the Slot_length parameter.

slot n	slot n+1	slot n+2	slot n+3
--------	----------	----------	----------



By the aid of an internal clock, the mobile terminal is able to detect slot boundaries. The definition of how slot boundaries are calculated is found in reference R1-17.

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The following happens in the free slots.

- 1 Traffic initiated before the start of the free cycle must be distributed at random. A random number generator selects a slot between 1 and Rand slots. Transmission begins at the start of the selected slot.
- 2 Traffic initiated during the free cycle is sent at the beginning of the next slot.
- 3 If the <MRM> to be sent is longer than MAX ACCESS or MAX SPEECH, a request for access must be made. The transmission of this request is done according to rules 1 or 2 above.

If the Data Link Layer is in the speech mode (ordered by the Network Layer), an <MRM> may be sent immediately. This is done independently of any free cycles.

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4.2.2 Mobile fleet division

The access permission in the free cycle can be given to parts (subsets) of the mobile fleet according to the setting of corresponding fields in the free signal, <FRI>. This is used to reduce the number of access attempts in a free cycle. The following principles are used:

- Masked addressing The address and mask fields in <FRI> are used for a binary division (1, 2, 4, 8 etc) of the mobile fleet.
- Priority Is used to give access only to mobile terminals above a stated priority level.
- Traffic type, PFG Is used to give access only for stated traffic types (emergency, data or speech).

In the <SVP> a channel (receiving and transmitting frequencies) and a channel type (local system or access channel) can be given. By using the addressing facilities in the <SVP> it is possible to assign a certain system and/or access channel to the whole mobile fleet or to parts of it.

The local system channel is used in much the same way as any other system channel. It is not shared by surrounding base stations and may thus be used without interference from these.

When assigned a local system channel, the mobile terminal monitors this channel until further notice or the roaming algorithm indicates that it is no longer usable.

When assigned an access channel, the mobile terminal must use this channel when it has an <MRM> to transmit. The access rules described above also apply to this channel. After the <MRM> has been acknowledged the terminal returns to the previous (local) system channel.

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4.3 ROAMING

The algorithm for selection of a suitable base is called roaming. It is designed to handle a nationwide system of base radio stations on different system channels, with either frequency or time division in their signalling. The algorithm includes two methods of channel monitoring; normal and quick.

A mobile terminal measures the received signal strength from all base radio stations. To evaluate one base station the mobile terminal calculates its roaming value. The roaming value is defined as the average received signal strength. Please see reference R1-17 for further information about how to measure received signal strength.

After a <BKT> or a <BKD> has been received, the monitoring is disabled. It is resumed after the connection/session is ended, and the same table of evaluations as before the connection is used.

When the terminal is switched on, it uses the CURRENT SYSTEM CHANNEL and the CURRENT BASE until this base becomes unsuitable according to the roaming algorithm. If no CURRENT BASE has been stored, the terminal immediately starts the quick channel monitoring, using the default list of system channels.

Lists of system channels

The mobile terminal uses a list of system channels when it monitors the base radio stations or searches for a new base. It is either a permanent or a temporary default list (please refer to the chapter 'SYSTEM PARAMETERS TO BE STORED IN THE TERMINAL' and to reference R1-06) or the current list (stated in the <SVP>-frame).

The default list is used until a <SVP>-frame has been received. A <SVP>-frame with a new list of system channels completely overrides the old current list.

The default list is also used in the quick channel monitoring after an unsuccessful search of the current list has been made. Again, the default list is used only until a valid <SVP>-frame with the current list of system channels has been received from the new base station.

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Measurement methods

When the mobile terminal measures the received signal strength it can use two different measurement procedures: FRAME or CONTINUOUS. Which of these it should use is stated by the parameter RSSI_PROC in the <SVP>-frame.

If RSSI_PROC states FRAME the mobile terminal measures the received signal strength of the frame heads received during the RSSI_PERIOD (stated in <SVP>).

If RSSI_PROC states CONTINUOUS the mobile terminal measures the received signal strength during the entire RSSI_PERIOD.

The parameter RSSI_PERIOD includes channel switching time, and has the default value 2 960 ms, with a tolerance of +/- 10 ms.

During monitoring of current system channel and when making the final decision before choosing a new base, the terminal measures average received signal strength during the reception of frame heads.

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Normal channel monitoring

A mobile terminal measures the received signal strength from base radio stations on the **CURRENT_SYSTEM_CHANNEL** and calculates a roaming value for each base station.

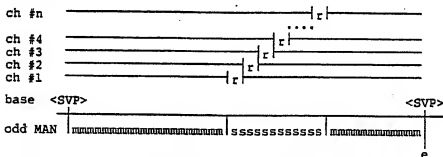
During each **<SVP>**-cycle (i.e. the time between two **<SVP>**-frames) the terminal leaves the **CURRENT_SYSTEM_CHANNEL** for a predefined period to monitor other channels and then return. These channels are chosen from the list of system channels (default or current). The start of the scan period depends on the terminal's own subscription number (MAN) being odd or even:

scan start(odd) = **TIME_TO_NEXT** - 10ms - 2***SCAN_TIME**
 scan start(even) = **TIME_TO_NEXT** - 10ms - **SCAN_TIME**

where

SCAN_TIME = Length of predefined scan period, including channel switching time. This is stated in the **<SVP>**-frame and has the default value 3 seconds, with a tolerance of +/- 10 ms..
TIME_TO_NEXT = Interval between two **<SVP>**-frames. This parameter is stated in the **<SVP>**-frame and has the default value 10 seconds.

Example:



where
 m = monitor current system channel
 s = scan other system channels
 r = RSSI PERIOD
 e = evaluation

The monitoring is cyclically repeated for all channels and every channel is monitored one **RSSI_PERIOD**.

For example, if the **RSSI_PERIOD** and **SCAN_TIME** have default values, the list contains 7 channels and the length of a **<SVP>**-cycle is 10 seconds, then the time between the scans of a specific channel from the list is 70 seconds. On the other hand, if the **RSSI_PERIOD** is 4 (80 ms) and **SCAN_TIME** is 30 (3 s) then the mobile will scan at least 30 channels during each **<SVP>**-cycle.

Stick

Report

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Criteria for leaving CURRENT_BASE

The mobile terminal leaves CURRENT_BASE during a <SVP>-cycle if:

- 1- roaming value (CURRENT_BASE) < BAD_BASE

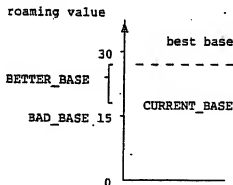
BAD_BASE is stated in the <SVP>-frame and its default value is 15.

or

- 2- roaming value (best base) > roaming value (CURRENT_BASE) + BETTER_BASE.

If this criterion is fulfilled, the mobile should remain in normal channel monitoring on the current system channel for another <SVP>-cycle. During the next scan period the mobile should measure the average received signal strength of frame heads from best base. If the roaming value still fulfils the criterion, the mobile should select this base as new CURRENT_BASE and the new channel as CURRENT_SYSTEM_CHANNEL.

The following figure shows an example where this criterion applies:



The parameter BETTER_BASE is stated in the <SVP>-frame and its default value is 10.

Blockchart

Diagram

A 296 51503

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The following criteria cause the mobile to leave CURRENT_BASE immediately without waiting for the end of the <SVP>-cycle:

- 3- The terminal has made MAX_REP retransmissions without getting an acknowledgement from base. The value of MAX_REP is stated in the <SVP>-frame.
- 4- The terminal has received a <NAT> (including an order to leave the CURRENT_BASE) from base.

And the last criterion applies when no traffic is exchanged:

- 5- The terminal has not received valid <SVP>-frames within 2 <SVP>-cycles (= 2*TIME_TO_NEXT).

Any of the above criteria, except -2-, causes the mobile terminal to leave CURRENT_BASE and evaluate other bases.

Evaluation of other base stations

MOB first evaluates the best base (≠ CURRENT_BASE) from the normal channel monitoring. This is done by evaluating the:

- roaming value from the last <SVP>-cycle (on CURRENT_SYSTEM_CHANNEL)
- roaming value from the last RSSI_PERIOD of a specific channel (on the other system channels)

If the base is on the CURRENT_SYSTEM_CHANNEL and have a roaming value greater than GOOD_BASE it can be directly selected as CURRENT_BASE.

But if the new base is on a new system channel the mobile shall measure the average received signal strength during the reception of frame heads on this channel for SCAN_TIME. If the measured roaming value is greater than GOOD_BASE, the mobile should select this channel as CURRENT_SYSTEM_CHANNEL and this base as CURRENT_BASE.

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Quick channel monitoring

If best base is not good enough, a quicker scanning procedure is adopted until a suitable base is found. MOB then scans its list of (current) system channels in the following way:

- 1- Begin with the first channel from the list.
- 2- Measure the average received signal strength for RSSI_PERIOD.
- 3- If the measured roaming value is greater than GOOD_BASE remain on this channel. Otherwise skip to step 6.
- 4- Measure the average received signal strength during the reception of frame heads on this channel for SCAN_TIME.
- 5- If the roaming value is greater than GOOD_BASE select this channel as CURRENT_SYSTEM_CHANNEL, the base as CURRENT_BASE and return to normal channel monitoring. Otherwise go to step 6.
- 6- Stop scanning if all channels of the list have been scanned. Otherwise choose next channel from list and repeat steps 2-5.

After MOB has scanned a number of channels from the list (please see reference R1-06) , or the list is ended, the current system channel is scanned in the same manner. The scan of the list is then resumed, if the end of the list was not already reached.

If the complete current list of system channels has been searched without a new base having been chosen, the quick channel monitoring is restarted with the default list of system channels.

Re-establishing contact

When a new CURRENT_BASE has been chosen, an <MRM>-frame with roaming information is sent to it. If the new BASE is identical to the old CURRENT_BASE, an <MRM>-frame with activation information is sent instead.

Budget

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Area identification

The frame header (on the physical layer) includes an area identification used to specify geographical areas. Such an area is denoted as a traffic area and is given a unique area ID by the network.

From the network layer, the data link layer receives a list including the areas subscribed to by the user. The list also shows if the areas not subscribed to are allowed to be used, with for example higher charges, or not.

From the physical layer, the data link layer receives information about incoming roam information, i.e. area ID, base ID and weighted roaming value.

During the roaming procedure (described above), the terminal will primarily evaluate roaming information from bases belonging to the subscribed traffic areas. If the terminal is allowed to traffic other areas all bases may be considered in the roaming procedure.

In case a "non-subscribed" base is chosen (possible only in quick channel monitoring), it should be notified to the application layer, as well as when the terminal returns to a "subscribed" base.

If the terminal have not yet received the list of area IDs, the roaming procedure will evaluate all base stations.

Booklet

Diagram

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4.4 ADDRESSING

4.4.1 Addressing the base radio station

The base radio station is only addressed in the frame head. Further details can be found in reference R1-17.

4.4.2 Addressing a mobile terminal

Transmitting The mobile terminal's subscription number (MAN) is always used as the MOB address.

Receiving When receiving, the MOB address refers to the mobile terminal's MAN, or any MAN representing a group to which the terminal belongs. (A transferred subscription is addressed in the MPAK.)

A MAN representing a group occurs only when receiving frame types <MRM>, <BKD>, <BKT>, <BBT> and together with a mask value of 0 in frame types <PRI>, <SVP>, <TST>. Masked addressing is described in detail in chapter 4.4.2.1.

Masked and priority addressing is used in frame types <SVP> and <TST>.

Masked, priority and traffic type addressing is used in frame type <PRI>.

Endsheet

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4.4.2.1 Masked addressing.

Masked addressing is only used in <SVP>, <PRI> and <TST>. In this addressing mode both the MASK and MOB fields of the frame are used. The MASK field indicates the number of bits from the beginning of the MOB field (most significant bits) that should not be considered (masked out) when comparing the MOB field with the terminal's MAN.

A MASK value different from 0 (zero) indicates that only the terminal's own MAN is to be compared with the relevant bits of the MOB field.

A MASK value of 0 (no bits masked out, all bits of MOB are relevant) indicates that the MOB field is to be compared with both the terminal subscription MAN and with the MANs of all current group numbers in the group list.

The terminal is considered to be addressed if all relevant bits of the MOB field are the same as the corresponding bits of one of the compared MANs.

A MASK value of 24 (decimal) indicates that all bits are masked out and that all mobile terminals are addressed.

Note: For <SVP> and <TST> signals the priority of the terminal must also comply with that of the signal.

For the <PRI> signal the priority and traffic type of the terminal must comply with that of the signal for the terminal to be addressed (except for emergency where priority is ignored).
(See below).

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Example: Assume a frame with the following contents in the MOB and MASK fields.

(x indicates that the corresponding bit is to be ignored)

MOB field Bit no. : 1 24
 Value : 101000000000101010110010

MASK field Bit no. : 1 5
 Value : 11000 (24 decimal)

Addressed MAN Bit no.: 1 24
 Value : xxxxxxxxxxxxxxxxxxxxxxxx

All mobile terminals are addressed.

MASK field Bit no. : 1 5
 Value : 10111. (23 decimal)

Addressed MAN Bit no.: 1 24
 Value : xxxxxxxxxxxxxxxxxxxxxx0

Only mobile terminal subscriptions with MAN ending with binary 0 are addressed.

MASK field Bit no. : 1 5
 Value : 10110 (22 decimal)

Addressed MAN Bit no.: 1 24
 Value : xxxxxxxxxxxxxxxxxxxxxx10

Only mobile terminal subscriptions with MAN ending with binary 10 are addressed.

MASK field Bit no. : 1 5
 Value : 00000 (0 decimal)

Addressed MAN Bit no.: 1 24
 Value : 101000000000101010110010

The MASK value 00000 (zero) indicates that mobile terminals with the terminal subscription MAN, or any of its MAN numbers representing groups, identical to the MOB field are addressed.

Subscribers

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4.4.2.2 Priority addressing

Priority addressing is used in the frames <SVP>, <TST> and <FRI>.

A terminal subscription belongs to one of 4 priority groups. The terminal may have two priority states within each group, normal or raised. The terminal will raise its priority if it has made MAX_REP retransmissions of the same frame without getting any acknowledgement from the base station.

PRI field	Meaning
7 111	Priority group 4, raised priority
6 110	" " normal
5 101	Priority group 3, raised priority
4 100	" " normal
3 011	Priority group 2, raised priority
2 010	" " normal
1 001	Priority group 1, raised priority
0 000	" " normal

When receiving a frame with priority addressing, the mobile terminal is addressed if its own priority is higher than or same as the received priority.

If the terminal is to transmit an emergency signal the priority level is ignored.

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4.4.2.3 Traffic type addressing

Traffic type applies to the type of MPAK to be sent from the mobile terminal. The packets are separated into 3 traffic types:

emergency: MPAK class PSOSCOM
 speech: MPAK class CSUBCOM
 data: All other types of MPAK

Traffic type addressing is used only in the <FRI> frame. The traffic type to which the <FRI> applies is coded into the FFG field as follows:

Value	Emergency	Speech	Data
00	yes	no	no
01	yes	no	yes
10	yes	yes	no
11	yes	yes	yes

Note: For the frames <SVP> and <TST>, both the masked address and the priority must be correct for the terminal to be addressed.

For the <FRI> to be valid, the masked address, the priority and the traffic type criteria must be met by the terminal, except for the transmission of an emergency signal where only the masked address and traffic type criteria has to be met (priority is ignored).

Signature

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4.5 SEQUENTIAL NUMBERING

The transmitting unit repeats the transmission of a frame if there is no response from the receiving unit. This means that the receiving unit can receive identical frames if its response is not detected by the transmitting unit. To avoid repeated presentation of information, certain types of frame are given sequential numbers. The principle is as follows.

- The terminal sets up a sequential register for the terminal subscription MAN (up and down sequential number) and for each of the MANs stored in GROUP_LIST (only a down sequential number for each).
- A sequential number is an integer with a value in the range (0...15). The sequential numbers are incremented cyclically 1, 2, 3..., 14, 1, 2, 3 etc. The values 0 and 15 are reserved for special purposes.
- The up sequential number applies to frames transmitted in the direction from MOB to BASE. The up sequential number is increased by one by the mobile terminal for each new <MRN>-frame transmitted.
- MOB which receives a sequentially numbered frame checks the sequential number of the frame against the stored down sequential number for the corresponding MAN. If the received sequential number is the same (and not 0, see below), the information in the frame is ignored. If the sequential number is not the same (or 0, see below), the frame is accepted and the sequential number of the received frame is stored (except for 15, see below). The number is stored when acknowledgement of the frame has been sent.
- On reception, the value 0 for a sequential number means that a sequential number check should not be carried out on the frame and that the value 0 should be stored in the terminal as the new down sequential number.
- On reception, the value 15 for a sequential number means that a sequential number check should not be carried out on the frame and that the old down sequential number remains.

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The up and down sequential numbers are set to 0 when not defined (e.g. at initial start up).

Down sequential numbers for group numbers are reset to 0 when roaming in on a new base station.

Also returned packets with status UNKNOWN should have a sequential number.

When the mobile is transmitting the following types of packets, the sequential number 15 should be used:

```
CSUBCOM:DISCON
CONREA
DTESERV:ACTIVE
INACTIVE
ROAM
BORN
```

Bulkart

Export

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4.6 OUTPUT POWER CONTROL

The MOBITE_X system allows for mobile terminals to control the output power via parameters in the system signalling, from the base radio station. Network operator requirements concerning this matter is stated in reference R1-06, as well as the nominal output power.

Requirements, such as the number of output levels to be controlled by the mobile terminal and in what steps the levels should be controlled, is also stated in reference R1-06.

The mobile terminal receives information about the output power to be used in the base station cell in question. This is stated by the parameter TXPOW in the <SVP>-frame.

Portable transmitters may have lower output power than ordinary transmitters. Note that the receiver sensitivity should be reduced or an offset should be added to the parameters GOOD_BASE and BAD_BASE used in the roaming procedure. This is done in order to keep the same ratio between the permitted transmission losses in the send and receive directions, i.e. to maintain a balanced radio path.

For example, if the power of the transmitter is 10 dB lower than the specified level, the receiver sensitivity could be reduced by 10 dB from the specified sensitivity level. Instead of reducing the sensitivity, an offset of 10 can be added to the parameters GOOD_BASE and BAD_BASE.

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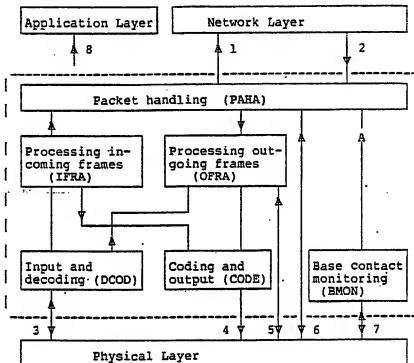
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4.7 LOGICAL DESCRIPTION

The data flow diagram below shows the interaction between modules in the Data Link Layer and between this layer and the Network and Physical Layers.



- 1- MPAK transmitted, MPAK not transmitted, MPAK received, roaming, activation
- 2- MPAK to transmit, MPAK to retransmit, speech on, speech off, order to return MPAK, list of area IDs, list of group numbers

Signals to/from Physical Layer:

- 3- Received block, Sync search
- 4- Frame to send, Frame length
- 5- Slot length, Chosen slot, Slot reached, Silence, Cannot send
- 6- Current base, Frame sent
- 7- Received base, Measure_RSSI, RSSI_measured

Signals to the Application Layer:

- 8- Speech queue info, base lost, base contact, area subscribed to chosen, area not subscribed to chosen

Bitchart

Diagram

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4.7.1 Input and decoding (DCOD)

DCOD converts the bit stream from the physical layer into frames. It decodes the blocks of these frames and checks that the frames are addressed to the terminal.

4.7.1.1 Logical description

```

LOOP
wait for information bits from Physical Layer
read and decode first block
IF first block is correct THEN
CASE frame type
WHEN <ACK>, <NAK>, <ATL>, <ATD>, <ATT>, <NAT> or <VKT>
IF frame address = terminal address THEN
send frame to OFRA
ENDIF
WHEN <REB>
IF frame address = terminal address THEN
read and decode remaining blocks of frame
IF frame is error-free THEN
send frame to OFRA
ENDIF
ENDIF
WHEN <PRI>, <SVP> or <TST>
IF (frame address with mask = terminal address) OR
(mask=0 and address = a group address) THEN
read and decode remaining blocks of frame
IF frame is error-free THEN
send frame to OFRA
ENDIF
ENDIF
WHEN <AKT> or <RES>
IF frame address = terminal address THEN
read and decode remaining blocks of frame
send frame to IFRA
ENDIF
WHEN <MRM>, <BKD>, <BKT> or <BBT>
IF (frame address = terminal address) OR
(frame address = a group address) THEN
read and decode remaining blocks of frame
send frame to IFRA
ENDIF
ENDCASE
ENDIF
send sync_search order to Physical Layer
ENDLOOP

```

Block:

Repeat:

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4.7.2 Processing incoming frames (IFRA)

IFRA handles the received frames from DCO. If a received <MRM> is not error-free, IFRA requests a repeat transmission of the faulty blocks until a correct <MRM> has been received and acknowledged.

4.7.2.1 Logical description

LOOP

wait for frame from DCO

CASE frame type

WHEN <MRM>

IF we have <MRM> waiting for <RES> THEN
delete that <MRM>

ENDIF

IF response required THEN

IF <MRM> is error-free THEN

create <ACK> and send it to CODE

send <MRM> to PAHA

ELSE

IF <MRM> is shorter than 3 blocks THEN

create <NAK> and send it to CODE

ELSE

create <REB> and send it to CODE

store <MRM> while waiting for <RES>

ENDIF

ENDIF

ELSE

IF <MRM> is error free THEN

send <MRM> to PAHA

ENDIF

ENDIF

WHEN <RES>

retrieve stored <MRM>

IF sequential number = stored <MRM>:s sequential
number THEN

complete <MRM> with error free blocks from <RES>

IF <MRM> is error free THEN

create <ACK> and send it to CODE

send <MRM> to PAHA

ELSE

create <REB> and send it to CODE

store <MRM> while waiting for <RES>

ENDIF

ENDIF

WHEN <BRT>, <BKD> or <BBT>

IF frame is error free THEN

send frame to PAHA

ENDIF

WHEN <ART>

create <ACK> and send it to CODE

ENDCASE

ENDLOOP

Bridport

Bridport

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4.7.3 Processing outgoing frames (OFRA)

OFRA handles the sending of frames. It must wait for permission to send, decide whether an access request is to be sent first etc.

OFRA receives <MRM>-frames of traffic types emergency, speech or data from PAHA. It returns them to PAHA with a statement of whether acknowledgement of the frame has been received or not. PAHA can also request that OFRA should cease trying to transfer the frame.

If the Data Link Layer is in speech_mode, an <MRM> may be sent immediately. This is done with a timeout that is independent of any free cycles.

OFRA is capable of handling only one <MRM>-frame at a time.

4.7.3.1 Logical description.

LOOP

```
wait for input signal
CASE input signal
WHEN new <MRM> from PAHA
  IF (free cycle is running) and (priority and traffic
    type allows transmission) THEN
    choose next free slot
    store <MRM> while waiting for slot_reached
  ELSE
    IF speech_mode THEN
      send copy of <MRM> to CODE for transmission
      speech_mode_timer := 2 seconds
    ELSE
      store <MRM> while waiting for permission to send
    ENDIF
  ENDIF
  cancel_request := FALSE

WHEN STOP SEND from PAHA
  return <MRM> to PAHA with status 'discontinued'
  IF speech_queue THEN
    IF free cycle is running THEN
      choose next free slot
    ENDIF
    speech_queue := FALSE
    cancel_request := TRUE
  ENDIF

WHEN SPEECH TRUE from PAHA
  speech_mode := TRUE
  speech_queue := FALSE

WHEN SPEECH FALSE from PAHA
  speech_mode := FALSE
```

Bulkart

Reprod

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Buildings

Ratios

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```

WHEN <ATD> from DCOD
  IF we have data <MRM> to send THEN
    send copy of <MRM> to CODE for transmission
  ENDIF

WHEN <ATT> from DCOD
  IF we have speech <MRM> to send THEN
    send copy of <MRM> to CODE for transmission
  ENDIF

WHEN <NAT> from DCOD
  IF we have speech <MRM> to send THEN
    IF order to leave CURRENT BASE THEN
      return <MRM> to PAHA with status 'failed'
    ELSE
      return <MRM> to PAHA with status 'no channel'
    ENDIF
  ENDIF
  speech_queue := FALSE

WHEN <ATL> from DCOD
  IF we have emergency <MRM> to send THEN
    send copy of <MRM> to CODE for transmission
  ENDIF

WHEN <SVP> from DCOD
  IF (sub type 1 or 2) and (priority is the same as or
    less than terminal priority) THEN
    send <SVP> to PAHA
  ENDIF

WHEN <TST> from DCOD
  send signal to Physical Layer that we cannot_send in
  any slot

WHEN <VRT> from DCOD
  speech_queue := TRUE
  queue_timer := timeout value
  send signal SPEECH_QUEUE_INFO to Application Layer

WHEN timeout of queue_timer
  speech_queue := FALSE

WHEN SILENCE from Physical Layer
  send signal to Physical Layer that we cannot_send in
  any slot

```

Signature

Deputy

A 296 51555

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```

WHEN SLOT REACHED from Physical Layer
IF we have <MRM> to send THEN
CASE <MRM> traffic type
WHEN emergency
IF <MRM> contains more blocks than MAX_ACCESS
THEN
create <ABL> and send to CODE for transmission
ELSE
send copy of <MRM> to CODE for transmission
ENDIF
WHEN speech
IF cancel_request THEN
cancel_request := FALSE
create <AAT> and send to CODE for transmission
ELSE
IF <MRM> with line connection request THEN
IF <MRM> contains more blocks than MAX_SPEECH
THEN
create <ABT> and send to CODE for
transmission
ELSE
send copy of <MRM> to CODE for transmission
ENDIF
ELSE
send copy of <MRM> to CODE for transmission
ENDIF
ENDIF
WHEN data
IF <MRM> contains more blocks than MAX_ACCESS
THEN
create <ABD> and send to CODE for transmission
ELSE
send copy of <MRM> to CODE for transmission
ENDIF
ENDCASE
increment counter of attempts to send
ENDIF
ENDCASE
ENDLOOP

```

Bidkret

Reprod

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4.7.4 Coding and readout (CODE)

CODE codes the blocks of the frame and transfers the bits to the Physical Layer.

4.7.4.1 Logical description

LOOP

Wait for frame to transmit

Code the blocks of the frame

Transfer the bits to the Physical Layer

ENDLOOP

Block

Reprod

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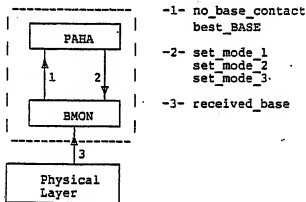
4.7.5 Base contact monitoring (BMON)

BMON monitors contact with the base station(s) and works in 3 different modes:

- 1- Normal Channel Monitoring
- 2- Quick Channel Monitoring
- 3- Disabled

For further information, see chapter ROAMING.

Input signals come from the Physical Layer and from PAHA:



- 1- no_base_contact
best_BASE
- 2- set_mode_1
set_mode_2
set_mode_3
- 3- received_base

Bitlows:

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4.7.6 Packet handling (PAHA)

PAHA handles the conversion between MPAKs and <MRM>-frames. It supervises the contact with BASE and informs the network when changing BASE and when returning after lost contact with the network.

PAHA is only capable of handling one MPAK at a time and it works in three different modes:

- Normal mode - Contact with a base station is established and the Network Layer may send and receive all types of MPAK.
- Speech mode - PAHA enters this mode only on order from the Network Layer. The Network Layer also decides which MPAKs that may be sent. PAHA leaves the speech mode on order from the Network Layer or when the transmission of an <MRM> has failed.
- Base search mode - When base contact is lost, PAHA enters base search mode. MPAKs from the Network Layer are not handled in this mode. When a base has been located, PAHA returns to normal mode.

The mobile terminal returns to the relevant system channel after the end of all sessions on other channels (channel_for_sending_speech, channel_for_sending_data).

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4.7.6.1 Logical description, main program

```

IF an old base is saved THEN
  send set_mode_1 to BMON
  system_channel := current_system_channel
  OFRA_status    := free
  main_mode      := normal_mode
ELSE
  main_mode      := base_search_mode
ENDIF

```

```

LOOP
  CASE main_mode
    WHEN normal_mode
      normal
    WHEN speech_mode
      speech
    WHEN base_search_mode
      base_search
  ENDCASE
ENDLOOP

```

Builders

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4.7.6.2 Logical description, normal (normal_mode)

```

WHILE main_mode = normal_mode
wait for input signal
CASE input signal

WHEN MPAK TO TRANSMIT from Network Layer
create <MRM> with new up sequential number
IF access channel opened THEN
change to access channel
channel := channel_for_sending_data
ENDIF
send <MRM> to OFRA
OFRA_status := busy

WHEN MPAK TO RETRANSMIT from Network Layer
create <MRM> with old up sequential number
IF access channel opened THEN
change to access channel
channel := channel_for_sending_data
ENDIF
send <MRM> to OFRA
OFRA_status := busy

WHEN SPEECH_ON from Network Layer
main_mode := speech_mode

WHEN RETURN MPAK from Network Layer
send stop_send to OFRA
wait to get frame that was in progress
return <MRM> to Network Layer with status 'not
transmitted'

WHEN <SVP> from OFRA
CASE sub type
WHEN 1
update parameters
WHEN 2
CASE type of channel
WHEN local system channel opened
system_channel := local
change to new system channel
WHEN local system channel closed
system_channel := previous
change to new system channel
WHEN access channel opened
store access channel
WHEN access channel closed
delete access channel
ENDCASE
ENDCASE

```

Bildschirm

Repro

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```

WHEN <BKT> from IFRA
  IF acknowledgement of <MRM> THEN
    send <ACK> to OFRA
  ELSE
    start timer with timeout value
  ENDIF
channel := channel for speech
change to designated channel
send set_mode_3 to BMON

WHEN <BKD> from IFRA
  IF it is a channel change to send frame THEN
    channel := channel_for_sending_data
  ELSE
    channel := channel_for_receiving_data
  ENDIF
start timer with timeout value
change to designated channel
send set_mode_3 to BMON

WHEN timeout for change of channel
  change to system channel
  send set_mode_1 to BMON

WHEN <BBT> from IFRA
  store new parameters and change channel

WHEN <MRM> with status 'OK' from OFRA
  OFRA_status := free
  return MPAK to Network Layer with status 'transmitted'
  priority := normal
  IF channel = channel_for_sending_data THEN
    change to system channel
    send set_mode_1 to BMON
  ENDIF
  reset timer for change of channel

WHEN <MRM> with status 'failed' from OFRA
  OFRA_status := free
  return MPAK to Network Layer with status 'not
  transmitted'
  priority := raised
  main mode := base search mode
  reset timer for change of channel

WHEN <MRM> with status 'no channel' from OFRA
  OFRA_status := free
  return MPAK to Network Layer with status 'not
  transmitted'
  priority := raised
  reset timer for change of channel
  
```

Bildschirm

Reprint

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```

WHEN incoming <MRM> from IFRA
CASE incoming sequential number
WHEN 0
  check_ok := TRUE
  store new down sequential number
WHEN 15
  check_ok := TRUE
WHEN OTHERWISE
  IF different from last seq. number received THEN
    check_ok := TRUE
    store new down sequential number
  ELSE
    check_ok := FALSE
  ENDIF
ENDCASE
IF check_ok THEN
  IF channel = channel_for_receiving_data THEN
    IF response NOT required THEN
      change to system channel
      send set_mode_1 to BMON
    ENDIF
    send MPAK to Network Layer
  ELSE
    delete <MRM>
  ENDIF
  reset timer for change of channel
WHEN Frame sent from Physical Layer
IF frame = <ACK> THEN
  IF channel = channel_for_receiving_data THEN
    change to system channel
    send set_mode_1 to BMON
  ENDIF
  reset timer for change of channel
ENDIF
WHEN no base contact from BMON
IF OFRA status = busy THEN
  send stop_send to OFRA
  wait to get frame that was in progress
  return <MRM> to Network Layer with status 'not
  transmitted'
ENDIF
main_mode := base_search_mode
ENDCASE input signal
ENDWHILE

```

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4.7.6.3 Logical description, base search (base search mode)

```
wait for input signal BEST BASE from BMON
IF roaming value > GOOD BASE THEN
  CURRENT BASE := new base
  CURRENT SYSTEM CHANNEL := new channel
  send signal ROAMING to Network Layer
  clear sequential numbers for all groups
  delete access channel
ELSE
  send signal BASE LOST to Application Layer
  send order set_mode_2 to BMON
  REPEAT
    wait for input signal BEST BASE from BMON
  UNTIL roaming value > CHOOSE BASE
  IF base = CURRENT BASE THEN
    send signal ACTIVATION to Network Layer
  ELSE
    CURRENT BASE := new base
    CURRENT SYSTEM CHANNEL := new channel
    send signal ROAMING to Network Layer
    clear sequential numbers for all groups
    delete access channel
  ENDIF
  send signal BASE_CONTACT to Application Layer
ENDIF
send set_mode_1 to BMON
main_mode := Normal_mode
```

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4.7.6.4 Logical description, speech (speech mode)

```

send speech_true to OFRA

WHILE main_mode = speech_mode

CASE input signal
WHEN speech_off from Network Layer
    wait 0.5 seconds
    change to system channel
    send set_mode 1 to BMON
    send speech_false to OFRA
    main_mode := normal_mode

WHEN new MPAK from Network Layer
    create <MRM> with new up sequential number
    send <MRM> to OFRA
    OFRA_status := busy

WHEN MPAK from Network Layer to be retransmitted
    create <MRM> with old up sequential number
    send <MRM> to OFRA
    OFRA_status := busy

WHEN <MRM> with status 'OK' from OFRA
    OFRA_status := free
    IF <MRM> with CSUBCOM:DISCON THEN
        change to system channel
        send set_mode 1 to BMON
        send speech_false to OFRA
        main_mode := normal_mode
    ENDIF
    return MPAK to Network Layer with status 'transmitted'

WHEN <MRM> with status 'failed' from OFRA
    change to system channel
    send set_mode 1 to BMON
    send speech_false to OFRA
    main_mode := normal_mode
    IF <MRM> with CSUBCOM:DISCON THEN
        send <MRM> to OFRA
    ELSE
        OFRA_status := free
        return MPAK to Network Layer with status 'not
        transmitted'
    ENDIF

WHEN <BBT> from IFRA
    store new parameters and change channel

```

Backport

Reprod.

A 297 11532

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```

WHEN incoming <MRM> from IPRA
CASE incoming sequential number
  WHEN 0
    send MPAK to Network Layer
    store new down sequential number
  WHEN 15
    send MPAK to Network Layer
  WHEN OTHERWISE
    IF different from last seq. number received THEN
      send MPAK to Network Layer
      store new down sequential number
    ELSE
      delete <MRM>
    ENDIF
  ENDCASE

WHEN signal from BMON
  ignore this signal
ENDCASE

ENDWHILE
  
```

Blanket

Report

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4.8 TRANSFER EXAMPLES

This chapter describes the most common transfer cases of the protocol.

4.8.1 Transfer without response

Transfer without response can only take place in the direction BASE to MOB.

In traffic to mobile terminal(s) BASE often addresses more than one MOB. This can apply to traffic to group numbers or frames where masked addressing occurs. In these cases MOB will not transmit a response. BASE states this by not setting the response flag in these frames.

Ex 1.1

Transfer without response, <MRM> BASE --> MOB

BASE <MRM>
MOB

-----> t

Bilker:

Begre:

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4.8.2 Transfer with simple acknowledgement

BASE has full control over the down frequency and can transmit an <MRM>-frame at any time to a certain MOB. If the response flag is set and no incorrigible bit error has been detected in the frame, MOB should reply with <ACK>.

Ex 2.1

Transfer with response, <MRM> BASE --> MOB

BASE	<MRM>
MOB	<ACK>

-----> t

Note that <ACK> is sent without considering slot boundaries and other access limitations.

Ex 2.2

Transfer with response, <MRM> MOB ---> BASE

BASE	<FRI>	<ACK>
MOB	<MRM>	

-----> t

By transmitting <FRI>, BASE allows MOB to transmit <MRM>.

In this case MOB expects an acknowledgement from BASE. The lack of an acknowledgement is indicated in this case by MOB receiving a <FRI> without having previously received acknowledgement of its frame. Frame repetition follows in this case.

Free slots is defined, and thus access permission to the up channel is granted, when BASE transmits a <FRI> with an address that is applicable to MOB. Access permission is withdrawn for a certain MOB if any of the following cases arise.

- 1 BASE transmits a silence signal (see reference RI-17). This signal applies to all terminals.
- 2 BASE transmits a <TST> with an address which applies to MOB.
- 3 The free-cycle period as defined in the <FRI>-signal expires.

Bulldoz

Repro

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4.8.3 Transfer with block repetition

If the receiver of an <MRM> detects that one or more of the following blocks is incorrigible, the receiver may request repetition of these blocks with a <REB>. The sender replies with a <RES>.

NOTE Block repetition occurs only on <MRM>-frames where the number of blocks is 3 or more.

EX 3.1

Transfer with block repeat, MOB ---> BASE

BASE		<REB>	<ACK>
MOB	<MRM>	<RES>	

The principle described in the figure above applies in the direction to BASE and in the direction to MOB.

Bildern:

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4.8.4 Transfer with frame repetition

Frame repetition can occur for three reasons:

- 1 The receiving unit transmits a <NAK>
- 2 The receiving unit does not transmit a response
- 3 The packet type results in frame repetition

EX 4.1

Transfer with negative acknowledgement MOB ----> BASE

BASE <MRM> <MRM>
MOB <NAK> <ACK>

If the receiving unit finds that the received frame is incorrectable and is less than 3 blocks, it can notify the sender unit by transmitting a <NAK>. The transmitting unit should then repeat the message. The principle above applies in both transmission directions.

The frame is repeated immediately after an <NAK> is received, regardless of slot boundaries.

EX 4.2

Transfer with frame repeat, MOB ----> BASE

BASE <FRI> <ACK> <FRI> <ACK>
MOB <MRM> <MRM>

In this example the first acknowledgement from BASE is destroyed by interference so that MOB retransmits the same message after the next free signal.

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Ex 4.3

Transfer with frame repeat, BASE ---> MOB

BASE	< MRM >	<MRM>
MOB	-----> t	

In this example, frame repeat is caused by the packet type demanding repeated transmission. The response flag is never set in this case.

This case occurs for MPAK to group numbers. To avoid repeated presentation of the information in the frame, the frame has got a sequential number. According to the principles for sequential numbering, MOB will ignore subsequent identical frames.

NOTE! At the restart of a base radio station, the sequential numbers for all groups are set to 0. This is done to ensure that mobiles will not loose the first message to a group. The consequence of this action will be that the first message may be presented MAX_REP + 1 times at the mobile terminal.

Sidebars

Reproes

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4.8.5 Transfer with access request

If an <MRM>-frame to be sent from MOB to BASE is longer than MAX ACCESS this <MRM> may not be sent during free slots. These longer frames are handled with access request, <ABD>, and access permission, <ATD>.

EX 5.1

Transfer with access request, MOB ----> BASE

```

BASE <PRI>          <ATD>          <ACK>
MOB   <ABD>          <MRM>
-----> t

```

The principle is that instead of MOB transmitting its <MRM>-frame, it transmits an <ABD>-frame. The reply to this request is an access permission, <ATD>. When MOB receives access permission, it immediately starts transmitting the <MRM>.

EX 5.2

Repetition with max_rep, MOB --> BASE

```

BASE <PRI> ..<PRI> ....<PRI>
MOB   <ABD>          <ABD>
-----> t1

```

t1: When the number of transmitted access requests is equal to MAX_REP+1 and another <PRI> is received, the MPAK is returned to the network layer and a new base is chosen.

Subnet:

Repetition:

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4.8.6 Transfer with line connection

The line connection session is described in reference R1-09. When MOB wants to send an <MRM> (containing a request for a line connection) longer than MAX SPEECH it must request access for this. The access request results in a channel change order. On the new channel the session for frames takes place to establish the line connection. When the line connection is concluded MOB returns to the system channel.

EX 6.1

Transfer with line connection

BASE c1	<PRI>	<BKT>				
BASE c2			<ATT>	<ACK>		
MOB c1	<ABT>					
MOB c2			<MRM>	...		
		t1		t2	t3	t

- t1: Disable roaming and start timeout with time from <BKT>.
- t2: Stop timeout.
- t3: Speech_on received from Network Layer.

Buskort:

Regres

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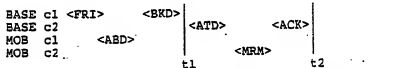
4.8.7 Transfer on several channels

Transfer on several channels can be divided into two separate cases:

- 1 MOB appears on another channel because BASE has stated in a <SVP>-frame that all traffic from a mobile terminal shall be sent on a channel other than that on which the <SVP> came.
- 2 BASE transmits a <BKD>-frame as a reply to an <ABD>.

EX 7.1

Transfer on several channels



- t1: Disable roaming and start timeout with time from <BKD>.
t2: Return to system_channel, enable roaming.

In this example, the access request from MOB resulted in a channel change order. The access permission is transmitted on channel c2. After having received an acknowledgement, MOB returns to channel c1.

Blindset

Re-proc

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4.8.8 Line connection with hand over

EX 8.1

Ordinary line connection

BASE1,c1	<FRI>	<BKT>				
BASE1,c2			<ATT>	<ACK>	...	speech
MOB, c1		<ABT>				
MOB, c2				CONREQ	...	speech
					t1	
						t

t1: Ordinary connection established.

EX 8.2

Continued with <BBT>

BASE2,c1						
BASE2,c3			.. speech .	<ACK>	
BASE1,c1						
BASE1,c2	<BBT>				
MOB, c1	
MOB, c2					
MOB, c3			.. speech .	DISCON		
	t2	t3		t4		t5
						t

t2: Hand over to base B2.

t3: MOB connected to base B2 on new speech channel, new system channel stored for later use.

t4: MOB breaks connection and changes to the new system channel.

t5: Connection ended.

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4.8.9 Line Connection with queue handling.

If no speech channel is immediately available, BASE may place MOB in a queue of callers and reply with <VKT>.

EX 9.1

Successfully established line connection

BASE1, c1	<FRI>	<VKT>	...	<BKT>			
BASE1, c2				<ATT>	<ACK>	speech	
MOB, c1	<ABT>		...				
MOB, c2				CONREQ		speech	
			t1	t2		t3	
							----->t

t1-t2: Waiting time.

t3: Connection established.

EX 9.2

Call attempt ended by BASE

BASE1, c1	<FRI>	<VKT>	...	<NAT>		
MOB, c1	<ABT>		...			
			t1	t2	t3	
						----->t

t1-t2: Waiting time.

t3: Call attempt ended.

EX 9.3

Call attempt ended by MOB

BASE1, c1	<FRI>	<VKT>	...			
MOB, c1	<ABT>		...	<AAT>		
			t1	t2	t3	
						----->t

t1-t2: Waiting time.

t3: Call attempt ended.

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EX 9.4

Call attempt ended by MOB

```

BASEL,cl <FRI> <VKT> |...| <VKT> |...| <AAT> |
MOB, cl <ABT> |...| t1 t2 t3 t4 t5
----->t
  
```

t1-t2: Waiting time.
 t3-t4: Waiting time.
 t5: Call attempt ended.

B. Albert

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4.8.10 Line connection without access request

When MOB wants to send an <MRM> (containing a request for a line connection) shorter than or equal to MAX_SPEECH no access request is needed.

The response to the <MRM> is a channel change order that includes an acknowledgement. The line connection is immediately established on the new channel.

EX 10.1

Line connection without access request

```
BASE c1 <FRI>      <BKT>
BASE c2
MOB  c1      <MRM>
MOB  c2      .. speech ..
-----> t
```

4.8.11 Ending a line connection

An <MRM> with a DISCON may be transmitted only once on the speech channel. If MOB have not received <ACK> within 2 seconds, it changes to the system channel and continues the transmission attempts according to the usual rules.

EX 11.1

Ending a line connection

```
BASE c1      <FRI>      <ACK>
BASE c2 ..speech.....|
MOB  c1      DISCON
MOB  c2 ..speech.. DISCON|
                               t1 t2 t3
-----> t
```

t1-t2: Timeout.

t2: Return to system channel, enable roaming.

t3: Connection ended.

Buttons:

Repro:

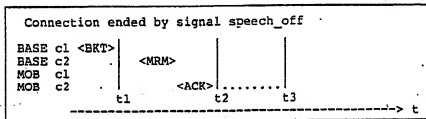
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4.8.12 Line connection ended by speech_off

After the mobile terminal has received an <MRM> containing a line connection request, the session may be put to an end by the signal speech_off from the network layer. This signal is generated by a timeout (please see reference R1-09) when the operator has not answered the call.

EX 12.1



- t1: Disable roaming and start timeout with time from <BKT>.
- t2: Stop timeout.
- t3: Speech_off received from Network Layer. Return to system channel and enable roaming:

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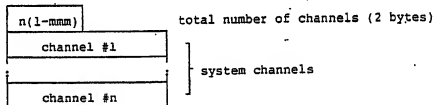
5 SYSTEM PARAMETERS TO BE STORED IN THE TERMINAL

Certain system parameters are stored continuously (even if the terminal is powered off) in MOB to permit correct action when starting up. These are:

- The terminal subscription MAN (GROUP LIST)
- Group number list (MAX_REP)
- Maximum number of retransmissions allowed (up/down)
- Sequential numbers - terminal MAN
- Current base
- Current system channel
- A list of the area identifications that the mobile is allowed to use. Please see reference R1-06.

When switched on, all these parameters apply until a frame is received containing the current parameter values.

There is also a permanent (and possibly a temporary) default list of system channels used by the roaming algorithm. They are stored continuously and have the following general format:



A channel is defined as a pair of frequencies and all the channels of this list are given in reference R1-06.

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Appendix

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6 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 17, 22, 31, 62
 RI-09, 4, 7, 55, 61
 RI-17, 5, 14, 17, 24, 50

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
RI-01	Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

Document

Reason

A 292 51543

REQUIREMENT SPECIFICATION 1(44)

Customer - Prepared ET/SYS IK	Facility/Service - Subject description ET/SYS IK	No 91/1056 - A 296 5171/A2 Ue
Customer's Comments - Not necessarily approved ET/SYSC STT <i>STT</i>		Date 1990-02-22 A
Beginning		File MTS16A.2
<p>Cantel Mobitex™</p>		<p>MOBITEX Data Link Layer, Mobile Terminal Appendix A, Frames, 8/16 kbps</p>
<p><u>ABSTRACT</u></p> <p>This document describes frame structure and coding for the Data Link Layer.</p>		
<p>Sketch</p>		
<p>Report</p>		

A 296 51533

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Doc No
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Revision Date Issue Date File
1990-02-22 A MTS16A.2

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Subpart

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1 INTRODUCTION

1.1 GENERAL

The mobile terminal's Data Link Layer together with the Physical Layer form a radio protocol for communication between mobile stations (MOB) and a base radio station (BASE).

The interchange of information between BASE and MOB is in the form of frames. There are 21 different types of frames.

Buildings

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2 FRAME TYPES

There are 21 different frame types:

	<u>Name</u>	<u>Designation</u>	<u>Transmitted by</u>	
			<u>BASE</u>	<u>MOB</u>
1	M frame	<MRM>	Yes	Yes
2	Acknowledgement	<ACK>	Yes	Yes
3	Negative acknowledgement	<NAK>	Yes	Yes
4	Repetition request	<REQ>	Yes	Yes
5	Repetition reply	<RES>	Yes	Yes
6	Access request, data	<ABD>	No	Yes
7	Access request, speech	<ABT>	No	Yes
8	Access request, emergency	<ABL>	No	Yes
9	Access permission, data	<ATD>	Yes	No
10	Access permission, speech	<ATT>	Yes	No
11	Access permission, emergency	<ATL>	Yes	No
12	Change channel, data	<BKD>	Yes	No
13	Change channel, speech	<BKT>	Yes	No
14	Free signal	<FRT>	Yes	No
15	Sweep signal	<SVP>	Yes	No
16	Silence order	<TST>	Yes	No
17	Activity request	<AKT>	Yes	No
18	No access permission, speech	<NAT>	Yes	No
19	Change base station, speech	<BBT>	Yes	No
20	Wait for channel, speech	<VKT>	Yes	No
21	Cancel access request, speech	<AAT>	No	Yes

Dissemination

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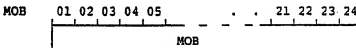
3 DESCRIPTION OF GENERAL FIELDS

In this chapter the general fields of a frame are described. Fields occurring only in specific frame types are described in conjunction with the definition of the respective frame type.

The fields are described in the following order:

- 1 MOB address of mobile terminal, or group
- 2 TYPE type of frame
- 3 BLOCK number of blocks in the frame
- 4 PARITY check sum
- 5 MASK for masked addressing
- 6 PRIO for priority addressing
- 7a UPFREQ frequency number, up frequency
- 7b DOFREQ frequency number, down frequency
- 8 NUMRET number of retransmissions

The most significant bit lies to the left in the field, has the lowest order number and is sent and received first in time.



MOB states the address of the mobile unit concerned. This address refers to the terminal's own subscription number, or to any number representing a group to which the terminal belongs.

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TYPE 01 02 03 04 05

TYPE

TYPE is bit 28-32 of the primary block and indicates the type of frame according to the following table:

Value		Type
Decimal	Binary	designation
01	00001	<MRM>
02	00010	<ACK>
03	00011	<NAK>
04	00100	<REB>
05	00101	<RES>
06	00110	<ABD>
07	00111	<ABT>
08	01000	<ABL>
09	01001	<ATD>
10	01010	<ATT>
11	01011	<ATL>
12	01100	<BKD>
13	01101	<BKT>
14	01110	<PRI>
15	01111	<SVP>
16	10000	<TST>
17	10001	<AKT>
18	10010	<NAT>
19	10011	<BBT>
20	10100	<VKT>
21	10101	<AAT>

BLOCK 01 02 03 04 05 06 07 08

BLOCK

States the number of blocks in the frame, including primary block.

PARITY 01 02 03 . . 14 15 16

PARITY

A frame comprises one or more blocks. A block comprises a source word and a coded parity word.

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MASK 01 02 03 04 05

MASK

A group of terminals is addressed with masked addressing. The MASK states the number of most significant bits of the MOB address that should be ignored.

PRIO 01 02 03

PRIO

PRIO	Meaning
7 111	Priority group 4, raised priority
6 110	" " " " normal
5 101	Priority group 3, raised priority
4 100	" " " " normal
3 011	Priority group 2, raised priority
2 010	" " " " normal
1 001	Priority group 1, raised priority
0 000	" " " " normal

UPFREQ 01 02 03 04 12 13 14 15 16

UPFREQ

|<-FBI-->|<---- FREQ. NO. ----->|

DOFREQ 01 02 03 . . . 12 13 14 15 16

DOFREQ

States the frequency number, UPFREQ for transmit frequency and DOFREQ for receive frequency.

Bit 1 to 3 gives FBI (frequency band and bit rate INFORMATION) and bit 4 to 16 gives the frequency number. Both the parameters are defined in reference R1-06.

NUMRET 01 02 03 04 05 06 07 08

NUMRET

States the number of retransmissions, including the current try.

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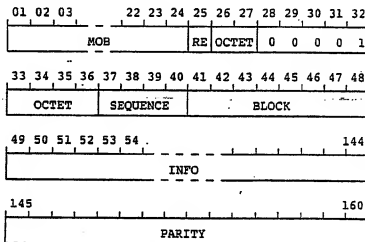
Doc No: 91/1056 - A 296 5171/A2 Ue
 Date: 1990-02-22 Rev: A File: MTS16A.2

4 FRAME TYPE DESCRIPTIONS

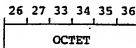
4.1 FRAME TYPE <MRM>, M-frame

APPLICATION An <MRM> is used to transfer packets. The packet format is defined in reference R1-09.

PRIMARY BLOCK



OCTET States the number of valid octets in the last following block. Remaining octets of the last block are filled with "0" to give a complete block. The field contains 6 bits and is used in the following way:



SEQUENCE States the sequential number of the frame.

RE States whether a response is to be given to the frame. The mobile terminal shall always set this flag to "1" on transmission.

INFO Contains 12 octets of source data from the packet.

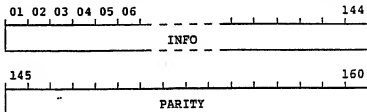
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Date - Date	Rev	Pl. Plu	
1990-02-22	A	MTS16A.2	

APPLICATION

The packet is placed in the following blocks with 18 octets from the packet in each. The number of valid octets in the last following block is indicated in the OCTET field of the primary block. The last following block is filled with "0" in the octets which do not belong to the packet.

**INFO**

Contains 18 octets of source data from the packet.

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4.2 FRAME TYPE <ACK>, Acknowledgement

APPLICATION An <ACK> acknowledges a correctly received frame.

<ACK> indicates that all blocks in the frame have been correctly received. It includes the sequential number of the received frame.

PRIMARY BLOCK

01	02	03				22	23	24	25	26	27	28	29	30	31	32
MOB									0	0	0	0	0	0	1	0
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
0	0	0	0	SEQUENCE							BLOCK					
49	50	51	52	53	54											144
0	0	0	0	0	0							0	0	0	0	0
145																160
PARITY																

SEQUENCE

States the sequential number of the corresponding <MRM>-frame.

FOLLOWING BLOCK

No following blocks in this type of frame.

Blockers

Support

91/1056 - A 296 5171/A2 Ue	
Date: 1990-02-22	Rev: A
File: MMS16A.2	

APPLICATION A <NAK> requests repetition of the entire
 <MRM>.

Note that if the number of blocks in <MRM> was 3 or more, <REB> is used instead of <NAK>.

[illegible]

States the sequential number of the corresponding <MRM>-frame.

No following blocks in this type of frame.

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 Revision Date 1990-02-22 Rev A FC-Fix MTS16A.2

4.4 FRAME TYPE <REB>, Repetition request

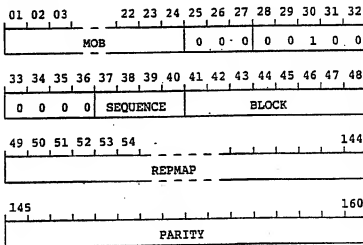
APPLICATION A <REB> requests repetition of erroneous blocks in an <MRM>.

If it is found during reception that certain blocks in a frame cannot be corrected, a request for these blocks to be repeated can be made by transmitting a <REB>. The request contains a bit map of the blocks to be repeated. This bit map refers to the original <MRM>, even during a sequence of repetitions.

<REB> contains the sequential number of the received <MRM> primary block and results in a <RES>.

Note that if the number of blocks in <MRM> was 2 or less, <NAK> is used instead of <REB>.

PRIMARY BLOCK



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No. 91/1056 - A 296 5171/A2 Ue
 Service Date 1990-02-22 Title A File No. MTS16A.2

SEQUENCE

States the sequential number of the corresponding <MRM>-frame.

REPMAP

Contains a bit map where each bit represents a block in the <MRM> previously received. A bit set to "1" indicates that the corresponding block is to be repeated. The bit in a REPMAP representing the primary block shall always have the value "0", since repetition of the primary block is illegal.

FOLLOWING BLOCK

No following blocks in this type of frame.

Indicates

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91/1056 - A 296 5171/A2 Ue		
Service Date	Rev	Fr. File
1990-02-22	A	MTS16A.2

APPLICATION A <RES> is the reply to a <REB>.

<RES> is a selective repetition of blocks from an <MRM>. The following blocks of the <RES> contain copies of blocks according to the bit map of the <REB>. <RES> contains the sequential number of the original <MRM>.

[illegible]

SEQUENCE States the sequential number of the corresponding <MRM>-frame.

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 1990-02-22 A MTS16A.2

FOLLOWING BLOCK

APPLICATION The following blocks contain copies of blocks according to the bit map of the <REB>. Only blocks requested to be repeated shall be packed into the following blocks. The order of the blocks is that stated in REPMAP.

01 02 03 04 05 06 144
 REPBLOCK

145 160
 PARITY

REPBLOCK The copy of a block from the original <MRM>-frame.

Widmark
 Reprod

91/1056 - A 296	5171/A2 Ue
Defect Date 1990-02-22	Rev A
	PC File MTS16A.2

APPLICATION An <ABD> is a request to transmit an <MRM> whose length (number of blocks) exceeds the value of MAX ACCESS.

If the length of the <MRM> exceeds MAX_ACCESS, access must be requested before the <MRM> may be sent.

The <ABD> states the number of blocks in the corresponding <MRM>.

01	02	03		22	23	24	25	26	27	28	29	30	31	32	
MOB							0	0	0	0	0	1	1	0	
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
BLOCK N								BLOCK							
49	50	51	52	53	54	55	56	57	144						
NUMRET								0	0 0 0						
145								160							
PARITY															

BLOCK N States the number of blocks for
 ..which access is requested.

FOLLOWING BLOCK No following blocks in this type
of frame.

References

Mr. No	91/1056 - A 296	5171/A2 Ue
Search Date	1990-02-22	RAW A
		Fu File MTS16A.2

Docum Date	Rev	File
1990-02-22	A	MTS16A.2

No following blocks in this type of frame.

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Submit Date	Rev
1990-02-22	A

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MTS16A.2

4.11 FRAME TYPE <ATL>, Access permission, emergency.

APPLICATION BASE replies with an <ATL> to an <ABL>
from a MOB, when BASE is ready to accept
an <MRM>.

When permission is granted, MOB is expected to transmit an <MRM> containing an emergency signal.

PRIMARY BLOCK

01	02	03													22	23	24	25	26	27	28	29	30	31	32		
MOB																		0	0	0	0	1	0	1	1		
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48												
0	0	0	0	0	0	0	0	0	BLOCK																		
49	50	51	52	53	54																				144		
0	0	0	0	0	0								0	0	0	0	0	0									
145																									160		
PARITY																											

FOLLOWING BLOCK

No following blocks in this type of frame.

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BRDFL Indicates how the terminal is to act on the new channel.

Bit 1 Reserved
 2 Reserved
 3 Reserved
 4 Change to send <MRM>
 5 Change to receive <MRM>
 6..16 Reserved

UPFREQ Frequency number for up frequency, i.e. the frequency on which the terminal transmits.

DOFREQ Frequency number of down frequency, i.e. the frequency on which BASE transmits.

TIMEOUT If error, return after TIMEOUT seconds (1-255).

FOLLOWING BLOCK No following blocks in this type of frame.

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91/1056 - A 296 5171/A2 Ue

Date - Date	Rev	File No
1990-02-22	A	MTS16A.2

APPLICATION A <BKT> orders a MOB to another channel in order to transmit or receive an <MRM> containing a request for line connection.

Normally the terminal returns to the original channel when the line connection is over. If an error occurs on the assigned channel then MOB returns to the original channel after a timeout period stated in the <BKT>..

01	02	03		22	23	24	25	26	27	28	29	30	31	32		
MOB									0	0	0	0	1	1	0	1
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
0	0	0	0	SEQUENCE				BLOCK								
49	64 65				80 81				96							
BRTFL				UPFREQ				DOFREQ								
97	104 105								144							
TIMEOUT				0 0				0 0 0 0 0 0								
145	160															
PARITY																

Findings

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Creation Date	Rev	File
1990-02-22	A	MTS16A.2

SEQUENCE Only valid if BKTFL bit 6 is TRUE.

BKTFL Indicates how the terminal is to act on the new channel.

- | | |
|-------|--|
| Bit 1 | Reserved |
| 2 | Reserved |
| 3 | Reserved |
| 4 | Change to send <MRM> |
| 5 | Change to receive <MRM> |
| 6 | Acknowledgement. (including sequence number) of correctly received speech <MRM>. Ignore timeout. |
| 7..16 | Reserved |

UPFREQ Frequency number for up frequency, i.e. the frequency on which the terminal transmits.

DOFREQ Frequency number of down frequency, i.e. the frequency on which BASE transmits.

TIMEOUT If error, return after TIMEOUT seconds (1-255).

FOLLOWING BLOCK

No following blocks in this type of frame.

Buildout

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A 292 51332

91/1056 - A 296 5171/A2 Use		
DATE	REV	FILE
1990-02-22	A	MTS16A.2

APPLICATION BASE transmits a <PRI> when it is ready to handle traffic from MOB.

A free signal precedes a free cycle. A free cycle is a period of time when all of, or parts of, the total fleet of mobile terminals are collectively permitted to transmit.

[illegible]

Bridges

~~Secret~~

Cantel Mobitex

Sp. No
91/1056 - A 296 5171/A2 Ue
Date Recd - Date
1990-02-22 A
PC File
MTS16A.2

FFG

The FFG field states the type of traffic to which the free signal applies according to the following table.

Value	Emergency	Speech	Data
00	yes	no	no
01	yes	no	yes
10	yes	yes	no
11	yes	yes	yes

RAND_SLOTS

The maximum number of the random number generator which selects in which slot the transmission shall start.

FREE_SLOTS

The number of free slots in this free cycle.

MAX_ACCESS

States the number of blocks which may be sent in an <MRM> without being preceded by an access request.

SLOT_LENGTH

Current value of slot_length.

MAX_SPEECH

States the number of blocks which may be sent in a line connection request without being preceded by an access request.

FOLLOWING BLOCK

No following blocks in this type of frame.

Editors

Reprod

A 292 51503

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Rev	MTS16A.2

4.15 FRAME TYPE <SVP>, Sweep signal

APPLICATION

The sweep signal is a periodically recurring signal from BASE. An <SVP> is transmitted by BASE for two reasons:

- 1 <SVP> marks the start of a sweep cycle.
- 2 <SVP> contains system parameters.

<SVP> has 2 different subtypes:

- 1 states the values of system parameters
- 2 states the frequency of different channel types

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AC: 100

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- states the values of system parameters.

[illegible]

Subkort

References

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SVTYP States the <SVP> subtype, value 00000001 in this case.

TXPOW States the decrease in output power (0-255 dB below nominal level) to be used by the mobile. A default value of 0 is used until this signal is received.

RSSI_PROC States the method of the signal strength measurement:
 0 = FRAME
 1 = CONTINUOUS
 The default value is FRAME.

RSSI_PERIOD Time used by the roaming algorithm (0-255 *20 ms).
 Default value: 148 (2 960 ms).

TIME_TO_NEXT States the time in seconds to the next <SVP> frame.
 Default value: 10.

MAX_REP States the value of the variable Max_rep.

BASEST States status of base station.

SCAN_TIME States the length of a period (0-255 *100 ms) when the terminal scans other system channels.
 Default value: 30 (3 seconds).

BAD_BASE Used by the roaming algorithm. 0-255 dBuV. Default value: 15.

GOOD_BASE Used by the roaming algorithm. 0-255 dBuV. Default value: 15.

BETTER_BASE Used by the roaming algorithm. 0-255 dB. Default value: 10.

Most of the parameters above are further described in the MAIN DOCUMENT.

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FOLLOWING BLOCKS

If any, they contain a list of system channels to be used in base station monitoring. A frame with a list containing new system channels completely overrides the previous frame. The channel list has the following format (as described in the MAIN DOCUMENT):

FOLLOWING BLOCK #1

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
number of channels									0	0	0	0	0	0	0
17								32	33						48
channel #1 - UPFREQ									channel #1 - DOPREQ						
49								64	65						80
channel #2 - UPFREQ									channel #2 - DOPREQ						
81								96	97						112
channel #3 - UPFREQ									channel #3 - DOPREQ						
113								128	129						144
channel #4 - UPFREQ									channel #4 - DOPREQ						
145															160
PARITY															

The number of following blocks depends on the size of the list. The maximum number of channels in the list is stated in reference RI-06.

Continues with following block #2 on the next page.

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FOLLOWING BLOCK #2

01	16 17	32
channel #5 - UPFREQ	channel #5 - DOPREQ	
33	48 49	64
channel #6 - UPFREQ	channel #6 - DOPREQ	
129	144 145	160
channel #9 - UPFREQ	PARITY	

FOLLOWING BLOCK #3

01	16 17	32
channel #9 - DOPREQ	channel #10 - UPFREQ	
33	48 49	64
channel #10 - DOPREQ	channel #11 - UPFREQ	

etc.

Bidder

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<SVP>, SUBTYPE 2

- states the frequency of different channel types.

PRIMARY BLOCK

01 02 03 22 23 24 25 26 27 28 29 30 31 32

MOB						0	0	0	0	1	1	1	1
-----	--	--	--	--	--	---	---	---	---	---	---	---	---

33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

PRIO				MASK				BLOCK							
------	--	--	--	------	--	--	--	-------	--	--	--	--	--	--	--

49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

SVPTYP								CHATYP							
--------	--	--	--	--	--	--	--	--------	--	--	--	--	--	--	--

65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

UFREQ															
-------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96

DOFREQ															
--------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

97 98 99 100 144

0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---

145 160

PARITY															
--------	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Bridgeport

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SVPTYP States the <SVP> subtype, value 00000010 in this case.

CHTYP States the type of channel:

Value:

- 1 Local system channel opened
- 2 Not used (ignore that order)
- 3 Local system channel closed (return to national system channel)
- 4 Access channel opened
- 5 Access channel closed

UPFREQ Frequency number for up frequency, i.e. the frequency on which the terminal transmits.

DOFREQ Frequency number for down frequency, i.e. the frequency on which BASE transmits.

FOLLOWING BLOCK

No following blocks in this type of frame.

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APPLICATION

Note: Please also refer to the description of the silence signal in reference RI-17. This signal has the same meaning as the <TST>-frame but uses only the frame head and thus addresses ALL mobile terminals.

01	02	03						22	23	24	25	26	27	28	29	30	31	32					
												MOB			0 0 0			1 0 0 0 0					
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48								
PRIO								MASK								BLOCK							
49	50	51	52	53	54												144						
0 0 0 0 0 0																	0 0 0 0 0 0						
145																			160				
PARITY																							

No following blocks in this type of frame.

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APPLICATION An <AKT> is used by BASE to check whether a certain MOB is active. MOB replies with an <ACK> to such a frame.

01	02	03		22	23	24	25	26	27	28	29	30	31	32	
MOB							0	0	0	1	0	0	0	1	
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
0	0	0	0	0	0	0	0	BLOCK							
49	50	51	52	53	54										144
0	0	0	0	0	0	-----				0	0	0	0	0	0
145														160	
PARITY															

FOLLOWING BLOCK No following blocks in this type
of frame.

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APPLICATION **BASE** replies with <NAT> to an <ABT> or a line connection request from a MOB when, for some reason, a line connection cannot be set up (e.g. no channel is available).

01	02	03				22	23	24	25	26	27	28	29	30	31	32
MOB									0	0	0	1	0	0	1	0
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	
0	0	0	0	0	0	0	0	BLOCK								
49	50	51	52	53	54	55	56	57							144	
NATFL									0				0	0	0	
145																160
PARITY																

NATFL
Bit 49
50 - 56

Contains the following orders:
 Leave CURRENT_BASE.
 Reserved

FOLLOWING BLOCK

No following blocks in this type
of frame.

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APPLICATION

BASE will use <BBT>

- as a response to an <ABT> when another base station is to be used for the line connection
- or
- to hand over a call in progress to another base station.

01 02 03 22 23 24 25 26 27 28 29 30 31 32

MOB

0 0

1 0 0 1 1

33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

TIMEOUT

BLOCK

49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

BBTFL

65 66 67 68 69 70 71 72 73 74-75 76 77 78 79 80

SPEECH UPFREQ

81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96

SPEECH DOFREQ

97 98 99 100 112

BASE

113 128

NEW SYSTEM UPFREQ

129 144

NEW SYSTEM DOFREQ

145 160

PARITY

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TIMEOUT If error, return after TIMEOUT seconds (1-255).

BBTFL Indicates the terminal is to act after changing to the new base station.

- Bit 49 Reserved
- 50 Reserved
- 51 After the call, use BASE as new current base station.
- 52 After the call, return to old current base.
- 53 Change and start the call set up procedure from the beginning (new <ABT> on BASE).
- 54 Change and continue (either signalling procedure or call in progress).
- 55-64 Reserved

BASE The identity of the new base station to be used.

SPEECH UPFREQ Frequency number for transmitting speech.

SPEECH DOFREQ Frequency number for receiving speech.

NEW SYSTEM UPFREQ Frequency number for upwards traffic on the new system channel, i.e. the frequency on which the terminal transmits.

NEW SYSTEM DOFREQ Frequency number for downwards traffic on the new system channel, i.e. the frequency on which the terminal receives.

FOLLOWING BLOCK No following blocks in this type of frame.

This order is only valid if both BBTFL 3 and BBTFL 6 are raised, i.e. hand over of a call in progress.

Other combinations of BBTFL are to be included in later versions.

Bitfields

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APPLICATION BASE replies with one (or more) <VKT>-frame(s) to an <ABT> from a MOB when a speech channel is not immediately available.

01	02	03		22	23	24	25	26	27	28	29	30	31	32	
MOB							0 0 0			1 0 1 0 0					
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
0 0 0 0 0 0 0 0								BLOCK							
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
TIMEOUT								QPOS							
65	66	67	68	69	70										144
0 0 0 0 0 0							0 0 0 0 0 0								
145															160
PARITY															

QPOS States current position (1-255) in queue.
It is recommended that this parameter is
passed on to the application layer and
shown to the operator.

Subjects:

References

4-56

Answer: **False**

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APPLICATION

PRIMARY BLOCK

145 160

PARITY

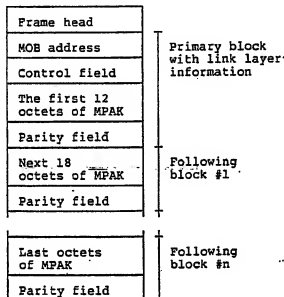
No following blocks in this type of frame.

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5 CONVERTING A PACKET TO A FRAME

<MRM>-frames conveys MPAKs over the radio channel. The primary block can accommodate 12 and each following block 18 octets from the MPAK.



When converting a packet to a frame, the first 12 octets in the packet shall be placed in the primary block of the frame. The last octets of the packet are placed in the last block. The primary block indicates how many octets in the last following block that are used. Unused octets in the last following block are filled with octets containing zeros.

In the primary block of the <MRM>-frame the Link Layer information is added. The MOB address field of the primary block shall always contain the MAN of the physical terminal concerned or, when the base station is transmitting to a group, the MAN of the addressed group. The base station identity is contained in the frame head preceding the primary block.

The addresses in the MPAK itself indicates the sub-
scriptions concerned (terminal, transferable or group). For packets to/from the terminal itself or its group numbers, the MOB address field of the primary block and the address in the MPAK are the same. For packets to/from a transferred subscription, the corresponding addresses differ.

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6 BLOCK CODING

6.1 GENERAL DESCRIPTION

The code used is a cyclic block code for burst error control. The code message consists of 144 source data bits and a block check character (CRC, i.e. parity) of 16 bits, giving a total of 160 bits in a block.

The generator polynomial defining the code is

$$g(X) = X^{16} + X^{12} + X^5 + 1$$

i.e. CRC-CCITT X.25.

The CRC is initialized to all ones, calculated from all the 144 source data bits of the block and then its one's complement is transmitted.

This code detects all (single) error bursts up to 16 bits in length and about 99,998% of all other error patterns.

6.2 IMPLEMENTATION

CRC calculations are customarily done in a multi-section shift register which feeds into an exclusive-OR gate whose output feeds back to other XOR gates located in between the sections of the shift register. The placement and quantity of XOR gates are defined by the generator polynomial.

The CRC is then transmitted after the source data of the block.

A logical arrangement identical to that used in the transmitter is also used in the receiver. Again the CRC-register is initialized to all ones, the CRC is calculated from the 144 source bits and its one's complement is compared to the received CRC. If these are different an error has been detected.

Instead of hardware logic a software algorithm may be used.

Blockset

Report

A 296 5150-3

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7 MOBITEX TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 7, 31
R1-09, 8
R1-17, 35

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEX System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

Blanket

Reprod

System Program ET/SYS IK	Functional Specification ET/SYS IK	No. 24 10/1056 - A 296 5171/02 Ue
Release/Version: Doc. resp. approved ET/SYSC STR <i>ST</i>		Issue Date: 1807 1990-02-26 A P. 24 MTS17.2
Description Cantel Mobitex™		Title MOBITEX Physical Layer, Mobile Terminal 8/16 kbps
<p>ABSTRACT</p> <p>This document specifies the Physical Layer for mobile terminals connected to the MOBITEX network.</p> <p>The exchange of information between base radio station and mobile is done by frames. A frame consists of a frame head and blocks.</p> <p>The frame head is added to the message sent by the Data Link Layer to establish synchronisation and identify the base station. It also includes a set of control flags.</p> <p>The blocks in a frame contain the data to/from the Data Link Layer plus parity bits for error correction.</p>		
<p>Submitted</p> <p>Approved</p>		

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Booklet

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1 INTRODUCTION

1.1 GENERAL

The protocol in the Physical Layer describes the way the mobile terminal handles the radio channel. The logical structure of the protocol is described in this document, while hardware-related functions such as:

- method of modulation
- suitable equipment for implementation
- requirements for the equipment

are presented in reference R1-18.

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2 THE CHANNEL

2.1 GENERAL CHARACTERISTICS

The channel between the base radio station and the mobile terminal uses

- separate frequencies for transmission and reception,
- synchronous communication and
- frequency modulation (FM).

It is also affected by

- varying field-strength,
- random errors and burst errors caused by fading and noise and
- bit errors caused by ignition interference.

Consideration has been given to these and other factors in the design of the protocol for the Physical Layer.

2.2 FRAME STRUCTURE

The exchange of information between base station and mobile is done by frames. A frame has the following structure:

Frame head	Block #1	Block #2	---	Block #n
------------	----------	----------	-----	----------

The frame head is a very important part of the frame. It is added to the message sent by the Data Link Layer to establish synchronisation and identify the base radio station.

The blocks in a frame contain the data to/from the Data Link Layer plus parity bits for error correction.

When the number of blocks is zero, i.e. when only a frame head is sent, the term "signal" is used.

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3 THE FRAME HEAD

3.1 STRUCTURE

The frame head has the following structure:

01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16

BIT SYNCHRONISATION

17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32

FRAME SYNCHRONISATION

33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

BASE IDENTITY

AREA IDENTITY

CTRL FLAGS

49 50 51 52 53 54 55 56

PARITY BITS

The different parts of the frame head are described in the following chapters.

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3.2 SYNCHRONISATION

3.2.1 Bit synchronisation

This preamble is provided to enable bit synchronisation in the demodulator. It consists of 16 bits with the following pattern (bit #1 is sent first):

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0	from BASE
0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	from MOB

3.2.2 Frame synchronisation

The frame synchronisation is provided to establish correct code word framing. Each network has its own pattern, used as network identification number, defined in reference R1-06. In order to roam into base radio stations in other networks, it should be possible to manually change the frame synchronisation word from the application layer.

It consists of 16 bits with the following structure, with bit #1 sent first:

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	from BASE
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	from MOB

If there is more than 1 bit error in the detected pattern, then frame sync is not established.

NOTE Only these 16 bits are used for frame synchronisation.

Sheet

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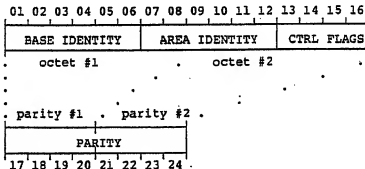
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3.3 AREA IDENTITY, BASE IDENTITY AND CONTROL FLAGS

The base identity (6 bits) and the area identity (6 bits) together, states the unique identity of the base radio station concerned. The most significant bit (01) in the addresses is sent first.

The base identity is followed by four control flags. They are only used in traffic from BASE to MOB. The control flags are as follows (in order of reception):

- 1 SA_flag Reserved for future use.
- 2 Set_slot_flag 0 = FALSE
1 = TRUE, reset slot clock.
- 3 Roaming_flag 0 = FALSE
1 = TRUE, this is a roaming signal, i.e. it contains only a frame head.
- 4 Silence_flag 0 = FALSE
1 = TRUE, this is a silence signal, i.e. it contains only a frame head.



The 8 (2*4) parity bits that follow the control flags are encoded in the same way as the blocks of the frame. Parity #1 is coded from octet #1 (see figure above) and parity #2 from octet #2.

The code corrects all single errors. In case the frame head could not be corrected, it should be rejected.

The parity bits may be ignored and the base identity and control flags read without any decoding.

Blockers

Repeat

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4 ERROR CORRECTION AND DETECTION

4.1 CODING

Each block to/from the Data Link Layer contains 20 octets of information. These are put into a matrix of the following format:

column -- 1 2 3 4 5 6 7 8 9 10 11 12 .

row 1	octet #1	parity
2	octet #2	
20	octet #20	

To each octet (column 1-8) four parity bits are added in the same row (9-12). These are encoded by a shortened (12,8) Hamming code.

The code corrects all single errors with hard decision decoding.

The code is defined by the following H-matrix:

$$H = \begin{bmatrix} 11101100 & 1000 \\ 11010011 & 0100 \\ 10111010 & 0010 \\ 01110101 & 0001 \end{bmatrix}$$

The syndrome (s) is calculated from the received code word (v) by

$$s = vH^T$$

where H^T denotes the transposed H-matrix.

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The syndrome of a code word with a single error is equal to the columnvector of the H-matrix corresponding to the position of this error. The syndrome table is shown below.

syndrome	corresponds to a single error in bit position
0	-
1	0000 0000 0001
2	0000 0000 0010
3	-
4	0000 0000 0100
5	0000 0001 0000
6	0000 0010 0000
7	0001 0000 0000
8	0000 0000 1000
9	0000 0100 0000
10	0000 1000 0000
11	0010 0000 0000
12	-
13	0100 0000 0000
14	1000 0000 0000
15	-

If the syndrome is 0 the code word is correct.

The following examples illustrate the coding/decoding procedure:

transmitted info parity	received info parity	syndrome
0000 0001 0101	0000 0001 0101	0000
0000 0101 1100	0101 0101 1100	1010
0000 0010 0110	0010 0010 0110	1011
0000 0101 1100	0000 1111 1100	1100

Block:

Pages:

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4.2 INTERLEAVING AND SCRAMBLING

Before transmission the code is interleaved to give protection against burst errors. The block-matrix is sent columnwise with start at position (1,1) and is received in the same way.

column -- 1 2 3 4 5 6 7 8 9 10 11 12

row 1	octet #1	parity
2	octet #2	
20	octet #20	

The code without interleaving can correct single errors. The interleaved code can thus correct a burst of 20 errors, assuming that there is no other error in the same block.

Scrambling

At transmission and reception the bits following the frame head should be added modulo-2 (exclusive-ored) with the output from the ninth stage of a binary nine-stage shift register.

The outputs of the fifth and ninth stage of the shift register should be added modulo-2 and the result fed back to the input of the first stage.

All bits in the shift register should be sent to the logical value 1 upon initialization for reception or transmission.

That is, the bits following the frame head will be exclusive-ored with the sequence:

11111111000001111011111000101...., etc.

This scrambling sequence is the recommended test sequence described in CCITT recommendation V.52, as well as the shift register on the next page.

Note: It should be possible, via a test command in MASC (reference R1-19), to order the mobile to start/stop sending the above described scrambling sequence. This should only be possible during test, not during normal operation.

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Shift register stages during pseudo-random pattern generation.

1	2	3	4	5	6	7	8	9	Out
1	1	1	1	1	1	1	1	1	1
0	1	1	1	1	1	1	1	1	1
0	0	1	1	1	1	1	1	1	1
0	0	0	1	1	1	1	1	1	1
0	0	0	0	1	1	1	1	1	1
0	0	0	0	0	1	1	1	1	1
1	0	0	0	0	0	1	1	1	1
1	1	0	0	0	0	0	1	1	1
1	1	1	0	0	0	0	0	1	1
1	1	1	1	0	0	0	0	0	0
0	1	1	1	1	0	0	0	0	0
1	0	1	1	1	1	0	0	0	0
1	1	0	1	1	1	1	0	0	0
1	1	1	0	1	1	1	1	0	0
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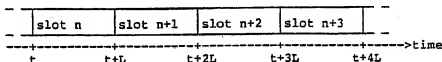
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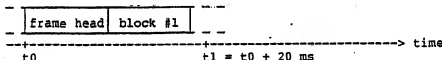
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5 TIME DIVISION

The time axis is divided into slots. The length (L) of one of these slots is given by the parameter Slot_length.



The mobile keeps a clock going to be able to detect slot boundaries. The start (t1) of the first slot in a sequence is defined by BASE transmitting a frame head with a Set_slot_flag.



The first bit of the frame head is received at time t0. Slot number n starts at:

$$t = t1 + (n-1)*L$$

where

$$L = \text{Slot_length} * (32/\text{bitrate}) \text{ seconds}$$

$$n = 1..x$$

The tolerance for determining the start of a slot is $-0.1/+3$ ms.

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6 TRANSMISSION

When an order to transmit a frame (FRAME_TO_SEND) has come from the Data Link Layer, the Physical Layer first waits until the slot clock reaches the CHOSEN_SLOT (please also refer to chapter 8) before it:

- indicates SLOT_REACHED to the Data Link Layer
- switches the carrier on
- waits until carrier frequency and power has stabilized
- waits 5 ms (tolerance -0/+5 ms)
- sends frame head with base and area identity (from Current_base) and all control flags = 0 (i.e. FALSE)
- encodes and sends all blocks of the frame

before it switches the carrier off and indicates FRAME_SENT to the Data Link Layer. If the order CANNOT_SEND comes from the Data Link Layer before the CHOSEN_SLOT is reached, then the transmission will not be started.

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7 RECEPTION

The following takes place when correct bit and frame synchronisation has been established:

```

get average signal strength during reception of
frame head *)
send Received base to Data Link Layer
IF received Base = Current_base THEN
  IF Silence_flag THEN
    send Silence to Data Link Layer
  ELSE
    IF Set_slot_flag THEN
      reset_slot_clock
    ENDIF
  REPEAT
    read block
    decode block
    send Received block to Data Link Layer
  UNTIL Sync_search
ENDIF
ENDIF

```

On reception of the order Measure RSSI from the Data Link Layer, the average signal strength *) is measured during the time stated in the order. Thereafter an answer, RSSI_measured, is sent to the Data Link Layer.

*) The RSSI should be sampled with a frequency of 1000 samples per second.

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8 INTERFACE TO THE DATA LINK LAYER

Parameters received from the Data Link Layer:

- Slot_length - states the length of a single slot. The unit is (32/bitrate) seconds.
- Chosen_slot - states the slot where transmission starts.
- Current_base - states which base radio station is currently used (base and area identity).
- Frame_to_send - is a message consisting of at least one block.
- Frame_length - states the number of blocks in message.
- Sync_search - orders the Physical Layer to stop reading and enter sync search mode.
- Cannot_send - orders the Physical Layer not to send in any slot.
- Measure_RSSI - orders the Physical Layer to measure the average received signal strength, during the time stated in the order.

Parameters sent to the Data Link Layer:

- Frame_sent - indicates that a frame transmission is completed.
- Received_block - is a decoded block (w error indication).
- Received_base - states the base identity, area identity and the received signal strength in dBuV.
- Silence - indicates that we have received a silence signal.
- Slot_reached - indicates the start of the Chosen_slot.
- RSSI_Measured - the average received signal strength, during in order Measure_RSSI stated time.

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9 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 6
R1-18, 3
R1-19, 10

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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REQUIREMENT SPECIFICATION 1(21)

Original Form ET/UC SIS	Facilitating Organization ET/UC SIS	No. 1056 - A 296 5173/04 De	
Disagreed/Disputed/Discontinued ET/SVSC STT <i>STT</i>		Version/Date 1990-02-25 A	Rev. No. MTS18.2
Description Cantel Mobitex -		Title MOBITEX Mobile radio equipment 8 kbit/s, 12.5 kHz channel spacing	

ABSTRACT

This document specifies the requirements for the radio transmitter and receiver in the MOBITEX MOBILE TERMINAL.

The document contains a functional description and a detailed specification of the technical requirements and performance of the transmitter and receiver.

The equipment specified in this document should also meet with basic requirements set up in national regulations for radio transmitters and radio receivers.

Environmental, power supply and operational control requirements are found in the document General Requirements for the Mobile Terminal.

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1 INTRODUCTION

1.1 GENERAL

The radio transceiver serves as interface between the radio path and the logic and control unit of the mobile terminal. Data and voice transmission is provided.

The transmission mode is semi-duplex, the base station operates in full duplex mode and the mobile station in two frequency simplex mode.

Digital FM modulation is used for data transmission at a speed of 8 kbit/s.

The channel spacing is 12.5 kHz.

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2 FUNCTIONAL DESCRIPTION2.1 DATA TRANSMISSION

The main traffic in the Mobitex network will be of the data transmission type.

A modulation type which makes it possible to utilize the radio transceiver for speech transmission as well as for data transmission has been chosen.

The modulation type is binary digital baseband filtered FM at a speed of 8 kbit/s.

There should be no squelch function during data transmissions.

During data transmissions the audio paths for speech transmissions to be muted.

The data transmission mode is used for transmission of system information, system orders and for the signalling between the base station and the mobile station as well as for the user data and text transmissions.

The data transmission mode is basically a simplex mode, data transmission takes place only in one direction at a time. Short switchover times are important as this will increase the system efficiency.

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2.2 SPEECH TRANSMISSION

The speech transmission mode is only reached after a request from either a mobile or a fixed terminal.

After a request for speech communication the base station allocates a radio channel and sends an order to the mobile station to switch over to that channel (separate transmit and receive frequencies).

No squelch function is to be used during speech communication.

The muting of the audio paths is released during speech communication. If, however, a data signal is detected during the speech, the audio paths to be muted immediately. This will for example occur when a data message is received during ongoing speech conversation.

2.3 TRANSMITTER CONTROL**2.3.1 Frequency**

The transmitter frequency is controlled by the control unit.

For information about frequency band and channel numbering plan to be used, please refer to document R1-06.

2.3.2 Carrier

The carrier on/off condition is controlled by the control unit during data transmissions. During speech transmission the carrier on/off condition is controlled by the manually operated transmit/receive switch.

Requirements of dynamic output power control can be made. In such a case, these are stated in reference R1-06.

There is to be a control circuit, independent of all other logic, which prohibits the continuous transmission of carrier for longer periods than 10 minutes.

2.3.3 Audio muting

The voice signal to the transmitter to be muted during data transmissions.

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2.4 RECEIVER CONTROL

2.4.1 Frequency

The receiver frequency is controlled by the control unit.

For information about frequency band and channel numbering plan to be used, please refer to document R1-06.

2.4.2 Squelch control

There must be no squelch function in the receiver.

2.4.3 Signal strength indication

The received signal strength level is used in the roaming algorithm for selection of base station.

Please refer to chapter RECEIVER in this document which includes a specification of the signal strength indication.

2.4.4 Audio muting

Whenever a data signal is detected, e.g detection of frame synchronization, the receiver voice output should be muted.

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3 PERFORMANCE AND TECHNICAL REQUIREMENTS

3.1 GENERAL

For definitions and measurement methods, please refer to Appendix A.

3.1.1 Frequency range

For information about which frequency band and channel numbering plan etc that will be used, please refer to document R1-06.

3.1.2 Frequency error

The frequency error of the transmitter and receiver shall not exceed (+)(-) 1.5 ppm.

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3.1.3 Data transmission

3.1.3.1 Modulator

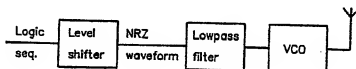


Figure 1. Block diagram of the method of modulation.

The modulation type is binary digital baseband filtered FM at a speed of 8 kbit/s. The method of modulation is shown in principle in Figure 1. The logic sequence to transmit is converted to a binary NRZ waveform by a level shifter and the NRZ waveform is filtered by a lowpass filter with linear phase characteristic.

The filtered waveform is applied as control input to a VCO, a voltage controlled oscillator. The lowpass filter reduces the deviation of the modulator for the high-frequency components of the binary modulating signal and thereby reduces the out of band emission of the transmitter.

A sequence of logic 1's should yield a transmitter frequency 2.0 kHz higher than the channel center frequency. A sequence of logic 0's should yield a transmitter frequency 2.0 kHz lower than the channel center frequency. That is the modulation index is 0.5.

The filter (or the equivalent filter in case of an other implementation) shall be a low pass filter with linear phase characteristic and a 3-dB frequency of 2.4 kHz. At a frequency two (2) times the 3-dB frequency the attenuation of the filter shall be 12 dB, and at a frequency four (4) times the 3-dB frequency the attenuation of the filter shall be 48 dB. The high frequency roll-off of the filter must be at least 40 dB/octave. A high frequency attenuation of 70 dB is considered sufficient. Figure 2 shows the amplitude response of the filter. The frequency modulator should be of a wide band linear type with frequency independent response in the frequency range 0 - 4 kHz or otherwise compensated in the baseband filter. An eye diagram of the transmitted signal is shown in Figure 3.

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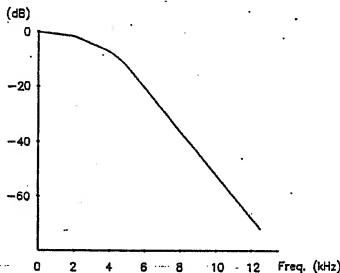


Figure 2. Amplitude response of lowpass filter.

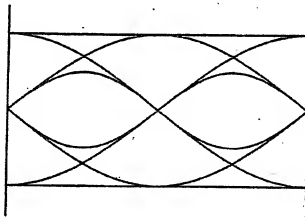


Figure 3. Eye diagram.

A preferred implementation of the baseband processing is oversampling of the bit-stream 4 - 8 times and digital filtering in a FIR (finite impulse response) filter with symmetric coefficients. This type of implementation can be realized by simple table look-up in a PROM.

The modulation rate is 8 kbits per second. The frequency error of the bitrate clock should not exceed ± 10 ppm. The error of the modulation index should not exceed ± 5 %.

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3.1.3.2 Demodulator

The demodulator should be of non-coherent type. A simple decision feedback or sequence detector should be used to resolve the small receiver eye opening of two subsequent bit transitions. A required bit error rate (BER) curve as a function of receiver input in a static receiver noise limited situation is shown in Figure 4.

The performance requirement of the complete receiving equipment when connected to a reference data transmitter is that the decoded block error rate should be less than 0.1 at the reference RF input signal level. At an RF input signal level 30 dB above the reference level, the decoded block error rate should be less than 0.0001.

It is essential that the demodulator keeps the synchronism with the incoming bit-stream during an entire message, even under disturbed conditions, in order to avoid repetition of other blocks than those which were actually disturbed.

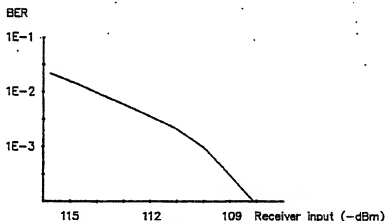


Figure 4. Bit error rate versus receiver input level.

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3.1.3.3 Start of data modulation

Data modulation must not start until the carrier frequency is within its 200 Hz from its steady state value and the carrier power is within 2 dB from its steady state value.

The transmitter carrier should be on for 5 -0/+5 ms before the start of transmission (frame head).

3.1.3.4 Receive/transmit switching times

The switching time from receive to transmit condition to be less than 20 ms including CPU handling time.

The switching time from transmit to receive condition to be less than 20 ms including CPU handling time.

3.1.4 Test terminals

Please note that the transceiver input/output terminals for voice must be accessible.

An interface according to the "machine interface" defined in reference R1-19, must be available during testing.

3.1.5 Test modulation

Short and long frames as defined in the link layer will be used during tests of data transmission.

It should be possible to force the modem to continuously transmit a sequence as specified in the national requirements for out of band emission testing.

It should be also be possible to force the modem to continuously transmit the scrambling sequence that is specified in Physical Layer Specification of the mobile terminal.

Normal audio test modulation is a 1 kHz test tone at such a level that the resulting deviation is ± 1.5 kHz.

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3.2 TRANSMITTER

For definitions and measurement methods, please refer to Appendix A.

3.2.1 Carrier power

The nominal output power is stated in reference R1-06. Requirements of dynamic output power control can be made. In such a case, these are also stated in reference R1-06.

Under normal test conditions and independent of selected channel the carrier output power during carrier on condition to be within (+)(-) 1,5 dB of the nominal output power. Under extreme test conditions the carrier output power to be within +2 dB and -3 dB of the nominal output power.

When the transmitter is in the carrier off condition, the carrier output power should not exceed 0,25uW.

The transmitter to be able to withstand load tests as described below:

- the change in the transmitter output power should not exceed 2 dB during a load test when the transmitter is loaded with a resistive load giving a standing wave ratio of 2. The test to be done at normal test conditions during 5 minutes of continuous transmission.
- without being damaged the transmitter should be able to withstand the same test at extreme test conditions.
- without being damaged the transmitter should be able to transmit for a period of 1 minute with the antenna terminal left open.
- the last mentioned test to be repeated with the antenna terminal short-circuit.

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3.2.2 Carrier rise and fall time

The carrier rise time and carrier fall time are included in the transmit-receive and receive-transmit switching times. Please refer to chapter "Receive/transmit switching times" in this document.

3.2.3 Channel switching time

The channel switching time should not exceed 30 ms.

3.2.4 Frequency deviation

3.2.4.1 Maximum permissible deviation

The maximum permissible frequency deviation to be (+)(-)2.5 kHz.

3.2.4.2 Data modulation

A long sequence of logic 1's (0's) should produce a carrier frequency deviation of +(-, for 0's) 2.0 kHz \pm 0.1 kHz.

3.2.4.3 Audio modulation

The normal audio test tone will produce a deviation of \pm 1.5 kHz.

3.2.4.4 Audio frequency response

The audio frequency response, measured through the audio signal input terminal, should have a 6 dB/octave pre-emphasis between 300 Hz to 2500 Hz. For frequencies higher than 3000 Hz, the frequency response should have a roll-off of at least 30 dB/octave.

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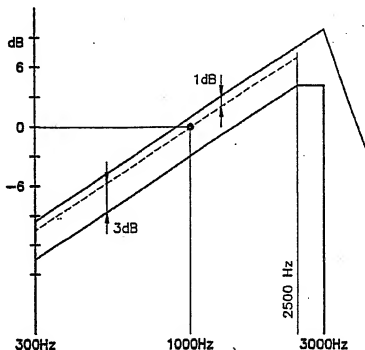


Figure 5. Frequency deviation relative to 1 kHz at constant input level.

3.2.5 Adjacent channel power

The adjacent channel power should not exceed the value specified in the national technical requirements, in case such a value is specified in the national technical requirements.

3.2.6 Harmonic distortion

The harmonic distortion factor should not exceed 5%.

3.2.7 Residual modulation

The residual modulation should not exceed - 40 dB, measured with a psophometric filter.

The residual modulation should not exceed - 20 dB, measured without filter.

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3.2.8 Modulation due to vibration

The modulation due to vibration should not exceed -30 dB measured by a r.m.s. voltmeter and with a psophometric filter.

Without the psophometric filter and measured by a peak-to-peak voltmeter the modulation should not exceed -14 dB.

3.2.9 Audio muting

An input muting device controlled by the control unit should be provided. The muting to be capable of causing at least 40 dB attenuation in the voice path. Data transmission is not to start until the muting has reached an attenuation of 40 dB.

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3.3 RECEIVER

For definitions and measurement methods, please refer to Appendix A.

3.3.1 Channel switching time

The channel switching time should not exceed 30 ms including data signal detection time.

3.3.2 Squelch opening and closing levels and delays

There must be no squelch function in the receiver.

3.3.3 Signal strength indication

The signal strength to be indicated by the receiver to the control unit.

The indicated range to be :

RF-level, 0 - 50 dBuV emf with a monotonic output and absolute accuracy of $\pm(2 + 10 \% \text{ of actual value})$ dBuV emf.

The time constant to be 1 ms.

3.3.4 RF sensitivity

The receiver sensitivity (speech) not to exceed 0 dBuV emf under normal test conditions and + 4 dBuV emf under extreme test conditions.

The reference signalling sensitivity (data) not to exceed 0 dBuV emf under normal test conditions, and 3 dBuV emf under extreme test conditions.

The multipath signalling sensitivity (data) must not exceed 12 dBuV emf. This measurement is only done under normal test conditions.

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3.3.5 Adjacent channel selectivity

The receiver shall comply with applicable national technical requirements.

3.3.6 Spurious response rejection

The receiver shall comply with applicable national technical requirements.

3.3.7 Co-channel rejection

The measurement is made with the wanted signal at an input level of +10 dBuV emf.

The co-channel rejection level at any frequency displacement of the unwanted signal within the specified range to be greater than -2 dBuV emf.

3.3.8 Intermodulation response

The receiver shall comply with applicable national technical requirements.

3.3.9 Blocking

The receiver shall comply with applicable national technical requirements.

3.3.10 Amplitude characteristic of the receiver

For the specified change of radio frequency input level, the change of the audio output level should not exceed 3 dB between the maximum and minimum output levels.

3.3.11 AM-suppression

The AM-suppression should not be less than 30 dB.

3.3.12 Audio frequency response

The audio frequency response, measured at the audio output terminal, should be within the limits as shown in the figure below.

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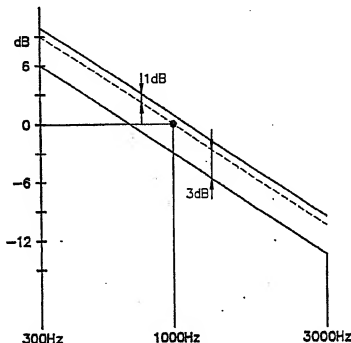


Figure 6. Audio power relative to 1kHz at constant frequency deviation.

3.3.13 Harmonic distortion

At all audio frequencies used in the measurement and under all test conditions the harmonic distortion factor should not exceed 5%.

3.3.14 Noise and hum

The receiver "noise and hum" ratio should not exceed -40 dB measured by a r.m.s. voltmeter and with a psophometric filter.

Without the psophometric filter and measured by a peak-to-peak voltmeter the "noise and hum" ratio should not exceed -20 dB.

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3.3.15 Audio output due to vibration

The noise and hum ratio of the receiver due to vibration should not exceed -30 dB measured by a r.m.s.voltmeter through a psophometric filter.

Without the filter and measured by a peak-to-peak voltmeter the the ratio should not exceed -14 dB.

3.3.16 Audio muting

An output muting device controlled by the control unit to be provided. The muting device to be capable of causing at least 40 dB attenuation in the voice path.

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System Date 1990-02-25 Rev. A Pz. File MTS18.2

4 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 6, 7, 8, 13
R1-19, 12

Below are the reference designations listed.

Reference	Section
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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System Guideline Description ET/SYSC STT <i>SN</i>		System Date 1990-02-23	Rev C
		P. No MTS18A.1	
<p align="center">Cantel Mobitex</p>		<p>MOBITEX MOBILE RADIO EQUIPMENT 12.5 kHz, 900 MHz Appendix A, Measurement methods</p>	
<p><u>1 INTRODUCTION</u></p> <p>This document is an Appendix to MOBITEX TERMINAL SPECIFICATION - RADIO EQUIPMENT. It consists of requirement definitions and measurement method descriptions.</p> <p>The measurement values applies to 12,5 kHz channel spacing in the 900 MHz frequency band.</p> <p>The document describes measurement methods for several data transmission speeds. Therefore, measurements without specified requirement procedures in the main document can be found. These should be ignored.</p> <p>The equipment specified in this document should also meet with basic requirements set up in national regulations for radio transmitters and radio receivers.</p>			
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2 MEASUREMENT METHODS

2.1 SYSTEM MEASUREMENTS

2.1.1 Receive to transmit switching time

Definition:

The switching time from receive to transmit condition is defined as the elapsed time from the end of an incoming frame with the response flag set, to the beginning of the response, i.e. the data signalling starts (see main document "Start of data modulation").

2.1.2 Transmit to receive switching time

Definition:

The switching time from transmit to receive condition is defined as the elapsed time from end of the last frame in a message sent by the transmitter, until the receiver is capable of detecting incoming data signals.

2.1.3 Channel switching time

Definition:

The channel switching time is defined as the elapsed time from the end of a received order to change channel, until the receiver is capable of detecting data signals on the new channel.

2.1.4 Frequency error

Definition:

The frequency error of the transmitter is the difference between the measured carrier frequency and its nominal value.

Method of measurement:

The carrier frequency should be measured in the absence of modulation with the transmitter connected to an artificial antenna.

The test should be made under normal and extreme test conditions.

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2.2 TRANSMITTER MEASUREMENTS

2.2.1 Carrier power

Definition:

The transmitter carrier power is the mean power delivered to the artificial antenna during a radio frequency cycle in the absence of modulation.

Method of measurement:

The transmitter should be connected to an artificial antenna and the power delivered to this artificial antenna should be measured.

The measurements should be made under normal and extreme test conditions.

2.2.2 Maximum permissible frequency deviation

Definition:

The frequency deviation is the maximum difference between the instantaneous frequency of the modulated radio frequency signal and the carrier frequency in the absence of modulation.

Method of measurement:

The frequency deviation should be measured at the output of the transmitter connected to an artificial antenna, by means of a deviation meter capable of measuring the maximum deviation, including that due to any harmonics and intermodulation products which may be generated in the transmitter.

2.2.3 Audio frequency response

Definition:

The audio frequency response is the frequency deviation of the transmitter carrier as a function of modulation frequency at a constant level of the modulation signal.

Method of measurement:

A modulation signal at a frequency of 1000 Hz and adjusted to such level that a frequency deviation of (+)(-)0,5 kHz is obtained, is applied to the transmitter. The frequency

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of the modulation signal is then varied between 300 Hz and 25 kHz, its level being kept constant. The connection values of frequency deviation and modulation frequency should be determined.

2.2.4 Adjacent channel power

Definition:

The adjacent channel power is that part of the total power output of a transmitter under defined conditions of modulation, which falls within a specified passband centred on the nominal frequency of either of the adjacent channels. This power is the sum of the mean power produced by the modulation, hum and noise of the transmitter.

Method of measurement:

The adjacent channel power should be measured with a power measuring receiver which fulfills the requirements given in the CEPT recommendation T/R 24-1. The transmitter should be operated at the nominal carrier power under normal test conditions. The output of the transmitter should be linked to the input of the receiver by connecting device such that the impedance presented to the transmitter is 50 ohms and the level at the "receiver" input is appropriate.

The transmitter should be modulated with a signal of 1250 Hz.

The signal of 1250 Hz should be adjusted to a level 20 dB higher than that required to produce (+)(-)1,5 kHz deviation. The "receiver" should be tuned to the nominal frequency of the transmitter and the variable attenuator in the "receiver" should be adjusted to a value p dB such that a meter reading of the order of 5 dB above the "receiver" noise level is obtained.

The "receiver" should then be tuned to the nominal frequency of one of the adjacent channels and the variable attenuator should be adjusted to a value q dB such that the same meter reading is obtained.

The measurement should be repeated with normal data test modulation (paragraph Test modulation, in the Main document).

The ratio of adjacent channel power to carrier power is the difference between the attenuator settings p and q. The adjacent channel power is determined by applying this ratio to the carrier power.

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The measurement should be repeated for the other adjacent channel.

2.2.5 Harmonic distortion

Definition:

The harmonic distortion factor of a transmitter modulated by an audio frequency signal is defined as the ratio, expressed as a percentage, of the r.m.s. voltage of all the harmonic components of the fundamental audio frequency to the total r.m.s. voltage of the signal after linear demodulation.

With the method described below, when a distortion meter is used, the hum and noise components are included in the distortion measurement.

Method of measurement:

The radio frequency signal produced by the transmitter is applied, by means of a suitable coupler, to a linear demodulator equipped with a de-emphasis network of 6 dB per octave.

The radio frequency signal to be modulated successively at frequencies of 300, 500 and 1000 Hz frequency to (+)(-)1.5 kHz deviation.

The harmonic distortion factor of the audio frequency signal is measured at all the frequencies given above.

2.2.6 Residual modulation

Definition:

The residual modulation of the transmitter is the ratio, expressed in dB, of the audio frequency noise level produced after radio frequency signal demodulation, in the absence of modulation, by the wanted signal, by the spurious effects of the power supply system, by the modulator or by other causes, to the audio frequency level produced by normal test modulation applied to the transmitter.

Method of measurement:

- a) The normal test modulation is applied to the transmitter. The RF signal produced by the transmitter is applied by means of a suitable coupler to a linear demodulator.

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The demodulator is equipped with a de-emphasis network of 6 dB per octave.

All precautions should be taken to prevent the measurement results from being affected by emphasis at the low audio frequencies of the internal linear demodulator noise.

Measurements to be carried out on the demodulator output signal by means of an r.m.s. voltmeter equipped with psophometric filter network described in CCITT Recommendation P.53.A.

The modulation is then removed and the level of the residual audio frequency output signal is again measured.

- b) The same method as a) above but without the psophometric filter at the output.

In this case the measurements are carried out by means of a peak-to-peak voltmeter.

2.2.7 - Modulation due to vibration

Definition:

Modulation due to vibration denotes the ability of the transmitter to withstand influence on the radio frequency output signal by mechanical vibrations.

Method of measurement:

The residual modulation is measured in accordance with 5.2.2. The transmitter should during the test be vibrated in each of three directions:

10 - 100 Hz 1 m/s²

sweep rate 1 octave per minute

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2.3 RECEIVER MEASUREMENTS

2.3.1 RF sensitivity

Definition:

The maximum usable sensitivity of the receiver is the minimum level of signal (emf) and field-strength respectively at the receiver input, at the nominal frequency of the receiver, with normal test modulation which will produce:

an audio-frequency output power of at least 50% of the rated power output and

a SND/ND ratio (S=signal, N=noise, D=distortion) of 20 dB, measured at the receiver output through a telephone psophometric weighting network as described in CCITT Recommendation P.53-A.

Note: The characteristics of the 1 kHz band-stop filter used in SND/ND measurements should be such that at the output the attenuation at 1 kHz will be at least 40 dB and at 2 kHz will not exceed 0.6 dB. The filter characteristics should be flat within 0.6 dB over the ranges of 20 Hz to 500 Hz and 2 kHz to 4 kHz. In the absence of modulation of the total noise power at the audio-frequency output of the receiver under test.

The reference signalling sensitivity data is the level and field-strength respectively of a radio frequency input signal at the nominal receiver frequency and modulated with the normal coded test signal or pseudo-random bit sequence which will produce a successful calling ratio of 80% for signalling systems with a specific response as output and a bit error ratio of 0.01 for data transmission systems with a bit stream as output respectively.

Measurement methods:

A signal of carrier frequency equal to the nominal frequency of the receiver and with normal test modulation shall be applied to the receiver input terminals. An audio frequency output load and a distortion factor meter incorporating a 1 kHz band-stop filter and a psophometric telephone weighting network shall be connected to the receiver output terminals. Where possible, the receiver volume control shall be adjusted to give at least 50% of the rated output power. The test signal input level shall be reduced until a SND/ND ratio of 20 dB is obtained. The test signal input level under these conditions is the maximum usable sensitivity. The measurement shall be made under normal test conditions and extreme test conditions. Under extreme test conditions, a variation of the receiver

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output power of (+)(-) 3 dB from the value obtained under normal test conditions may be allowed.

A signal of carrier frequency equal to the nominal frequency of the receiver and modulated with the normal coded test signal or a pseudo-random bit sequence shall be applied to the receiver input terminals. The level of this signal shall be such that a successful calling ratio of SCR = 80%, and a bit error ratio of BER = 0.01 respectively is obtained. The reference signalling sensitivity (data) is the maximum level of the levels recorded for SCR = 80% and BER = 0.01.

The multipath signalling sensitivity is the rms value of the level of a Rayleigh fading input signal at the nominal receiver frequency and modulated with the normal coded test signal or pseudo-random bit sequence which will produce a successful calling ratio of 80% and a bit error rate of 0.01. The measurements shall be carried out with a Rayleigh fading simulator set for a simulated vehicle speed of 90 km/h and repeated for a simulated vehicle speed of 50 km/h and 10 km/h. The reference multipath signalling sensitivity (data) is the maximum necessary level of the multipath measurements.

2.3.2 Adjacent channel selectivity

Definition:

The adjacent channel selectivity is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal which differs in frequency from the wanted signal by an amount equal to the adjacent channel separation for which the equipment is intended.

Method of measurement:

Two signals should be applied to the receiver via a combining network. The wanted signal should be at the nominal frequency of the receiver and be modulated with normal test modulation. The unwanted signal should be at the nominal frequency of the upper adjacent channel and be modulated with a 400 Hz tone to a frequency deviation of (+)(-)1,5 kHz.

Initially the unwanted signal should be switched off and the level of the wanted signal should be adjusted to 6 dBuV-emf. The unwanted signal should then be switched on and its level adjusted until the SMD/ND ratio, measured at the receiver line output terminal through the psophometric filter, is reduced to 14 dB.

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The measurement should be repeated with the unwanted signal at the nominal frequency of the lower adjacent channel.

The adjacent channel selectivity should be expressed as the lower value of the receiver input levels in dBuV emf of the unwanted signal for the upper and lower adjacent channels.

2.3.3 Spurious response rejection

Definition:

The spurious response rejection is a measure of the capability of the receiver to discriminate between the wanted modulated signal of the nominal frequency and an unwanted signal at any other frequency at which a response is obtained.

Method of measurement:

Two input signals should be applied to the receiver via a combining network. The wanted signal should be at the nominal frequency of the receiver and be modulated with normal test modulation. Initially the unwanted signal should be switched off and the wanted input signal adjusted to 6 dBuV emf. The unwanted signal should be switched on and modulated with a 400 Hz tone to a frequency deviation of (+)(-)1,5 kHz. The input level of the unwanted signal should be 86 dBuV emf and its frequency should be varied at least from 100 kHz to 2000 kHz.

At any frequency at which a response is obtained, the input level of the unwanted signal should be adjusted until the S/N ratio, measured at the line output terminal of the receiver through the psophometric filter, is 14 dB.

The spurious response rejection should be expressed as the level in dB of the unwanted signal relative to 1 uV emf at the receiver input when the S/N ratio of 14 dB, as mentioned above, is obtained.

2.3.4 Co-channel rejection

Definition:

The co-channel rejection is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of an unwanted modulated signal, both signals being at the nominal frequency of the receiver.

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Method of measurement:

Two input signals should be applied to the receiver via a combining network. The wanted signal should have normal test modulation. The unwanted signal should be modulated with a frequency of 400 Hz to a frequency deviation of (+)(-)1,5 kHz. Both input signals should be at the nominal frequency of the receiver and the measurement should be repeated for displacements of the unwanted signal up to (+)(-)1,5 kHz offset frequency of the nominal frequency.

Initially the unwanted signal should be switched off and the level of the wanted signal should be adjusted to +6 dBuV emf. The unwanted signal should then be switched on.

The level of the unwanted signal should be adjusted until the SMD/ND ratio, measured at the line output terminal of the receiver through the psophometric filter, is reduced to 14 dB.

The co-channel rejection should be expressed as the ratio in dB of the level of the unwanted signal to the level of the wanted signal at the receiver input for which SMD/ND = 14 dB at the receiver line output terminal occurs.

2.3.5 Intermodulation response

Definition:

The intermodulation response is a measure of the capability of the receiver to receive a wanted modulated signal without exceeding a given degradation due to the presence of two or more unwanted signals with a specific frequency relationship to the wanted signal frequency.

Method of measurement:

Three signal generators, A, B and C, should be connected to the receiver via a combining network.

The wanted signal, represented by signal generator A, should be at the nominal frequency of the receiver and should have normal test modulation.

The unwanted signal from signal generator B should be unmodulated and adjusted to the frequency separated by 25 kHz above the nominal frequency of the receiver.

The second unwanted signal from signal generator C should be modulated with a frequency of 400 Hz with a deviation of 1,5 kHz and adjusted to the frequency 50 kHz above the nominal frequency of the receiver.

Figures

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The amplitude of the wanted input signal should be adjusted to 6 dBuV emf. The amplitude of the two unwanted signals should be maintained equal and should be adjusted until the SND/ND ratio at the receiver output, psophometrically weighted, is reduced to 14 dB.

The frequency of signal generator B should be adjusted slightly, if necessary, to produce the maximum degradation of the SND/ND ratio. The level of the two unwanted test signals should be readjusted to restore the SND/ND ratio of 14 dB.

The measurement should be repeated with the unwanted signal B at 25 kHz below that of the wanted signal and the frequency of the unwanted signal C at 50 kHz below that of the wanted signal.

The intermodulation response level is the receiver input level in dB produced by each of the two unwanted signal generators relative to 1 uV emf.

2.3.6 Blocking

Definition:

Blocking is a change (generally a reduction) in the wanted output power of a receiver or a reduction of the SND/ND ratio due to an unwanted signal on another frequency.

Method of measurement:

Two input signals should be applied to the receiver via a combining network. The wanted signal should be at the nominal frequency of the receiver and should have normal test modulation. Initially the unwanted signal should be switched off and the input level of the wanted signal should be adjusted to 6 dBuV emf.

The output power of the wanted signal at the line output terminal of the Receiver should be adjusted to the nominal output level. Then the unwanted signal should be switched on. The unwanted signal should be unmodulated, and its frequency should be varied between +1 MHz and +10 MHz, and also between -1 MHz and -10 MHz, relative to the nominal frequency of the receiver. The input level of the unwanted signal, at all frequencies in the specified ranges, should be so adjusted that the unwanted signal causes:

a) a reduction of 3 dB in the audio frequency output power of the wanted signal,

or

b) a reduction of the SND/ND ratio to 14 dB, measured through a psophometric filter,

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whichever occurs first.

This input level is the blocking level at the frequency concerned.

2.3.7 Amplitude characteristics

Definition:

The amplitude characteristics of the receiver is the relationship between the radio frequency input level of specified modulated signal and the audio-frequency level at the receiver output.

Method of measurement:

A test signal at a level of 6 dBuV emf at the nominal frequency of the receiver and having normal test modulation should be applied to the receiver input. The audio frequency power at the line output should be adjusted to the nominal level. The input signal should be increased to 100 dBuV emf, and the audio frequency output level should again be measured.

2.3.8 AM-suppression

Definition:

AM-suppression is the capability of the receiver to suppress amplitude modulated signals. It is expressed as the ratio in dB of the audio power at the line output terminal with normal test modulation to the audio power with a specified amplitude modulation.

Method of measurement:

A test signal at a level of 20 dBuV emf and 60 dBuV emf at the nominal frequency of the receiver to be applied to the receiver input successively. The signal should initially have normal test modulation and the voice output terminal power should be set to the nominal output level. The normal test modulation should then be replaced by amplitude modulation to 30% with a 1000 Hz tone. The audio power should again be measured. It may be necessary to make this measurement with a selective voltmeter.

2.3.9 Audio frequency response

Definition:

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The audio frequency response of the receiver expresses the variation in the audio power at the line output terminal as a function of the modulation frequency of the input signal.

Method of measurement:

A test signal at a level of 60 dBuV emf at the nominal frequency of the receiver and having normal test modulation to be applied to the receiver input.

The audio power to be adjusted to 50 % of the rated output power. This setting is not to be altered during the test.

The frequency deviation at 1000 Hz then should be reduced to (+)(-)0,5 kHz and maintained constant while the modulation frequency is varied at least between 300 Hz and 5000 Hz.

The measurement is repeated with the test signal successively at plus and minus 1,25 kHz from the nominal frequency of the receiver.

2.3.10 Harmonic distortion

Definition:

The harmonic distortion factor at the voice output terminal of the receiver is defined as the ratio, expressed as a percentage, of the r.m.s. voltage of all the harmonic components of the fundamental audio frequency to the total r.m.s output voltage.

With the method of measurement described below in case a distortion meter is used, the hum and noise components are included in the distortion measurement.

Method of measurement:

Test signals of 60 dBuV emf and 100 dBuV emf at the nominal frequency of the receiver should be applied successively to the receiver input.

In each measurement the audio power at the voice output terminal should be adjusted to the nominal output level.

The test signal to be modulated successively with 300, 500 and 1000 Hz tones to (+)(-) 1,5 kHz frequency deviation and the harmonic distortion is measured at each frequency.

Under extreme test conditions, tests to be carried out at the nominal frequency of the receiver as well as at plus

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and minus 1,25 kHz from the nominal frequency. In this case the input signal is modulated only with a 1000 Hz tone to a frequency deviation of (+)(-) 1,5 kHz.

2.3.11 Noise and hum

Definition:

The "noise and hum" of the receiver is the ratio, expressed in decibels, of the audio frequency noise and hum level resulting from the spurious effects of the power supply system or from other causes to the audio frequency level produced by RF-signals as specified below and applied to the receiver input.

Method of measurement:

- a) A test signal at a level of 30 dBuV emf at the nominal frequency of the receiver and having normal test modulation should be applied to the receiver input. A psophometric filter to be connected at the voice output terminal. The audio power to be adjusted to nominal level.

The output voltage is measured with an r.m.s. voltmeter.

The modulation is then removed and the audio power measurement is repeated.

- b) The same method as in case a) above, but without the psophometric filter and using a peak-to-peak voltmeter for the measurement.

2.3.12 Audio output due to vibration

Definition:

Audio output due to vibration denotes the ability of the receiver to withstand influence on a received radio frequency signal by mechanical vibrations.

Method of measurement:

The noise and hum of the receiver is measured in accordance with 5.3.6. The receiver should during the test be vibrated in each of 3 directions.

10 - 100 Hz 1 m/s²

sweep rate 1 octave per minute

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During the vibration the radio frequency test signal should be unmodulated and the level of the receiver output signal should be measured.

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2.4 MEASUREMENT ACCURACY

The measurement instrumentation should have at least the accuracy given below:

D.C voltage	(+)(-)1%
A.C mains voltage	(+)(-)3%
A.C mains frequency	(+)(-)0,5%
Audio-frequency voltage, power, etc.	(+)(-)0,5 dB
Audio-frequency	(+)(-)0,1%
Distortion and noise, etc of audio frequency generators	(+)(-)0,5%
Radio frequency	(+)(-)20 Hz
Radio frequency voltage	(+)(-)2 dB
Radio-frequency field strength	(+)(-)3 dB
Radio-frequency carrier power	(+)(-)5%
Impedance of artificial loads, combining units, cable, plugs, attenuators, etc.	(+)(-)5%
Source impedance of generators and input impedance of measuring receivers	(+)(-)10%
Attenuation by attenuators	(+)(-)0,5 dB
Temperature	(+)(-)1°C
Humidity	(+)(-)5%
Time	(+)(-)10%

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Cantel Mobitex		MOBITEX Other interfaces, mobile terminal and fixed terminal
<p><u>ABSTRACT</u></p> <p>This document specifies the interfaces between the MOBITEX network and a mobile or fixed terminal connected to the network.</p>		
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APPENDIX A: Mobitex ASynchronous Communication, Commands.

APPENDIX B: Application example of how to connect fixed terminals via MCU.

APPENDIX C: Mobile terminal monitoring channels, other than MOBITEX, for special purposes(1200 Bps terminals only).

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1 INTRODUCTION

1.1 GENERAL

The purpose of this specification is to give well defined interfaces for the connection of application equipment. This specification will serve as a recommendation for the mobile terminal market.

NOTE: The Radio/MCU must be type-tested with a terminal of "masc" type. A minimum number of commands (defined by document Mobitex ASynchronous Communication, APPENDIX A, Commands) are then required.

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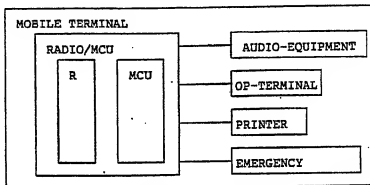
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2 GENERAL DESCRIPTION

The picture below shows the mobile terminal system parts.



MOBILE TERMINAL : complete equipment
MCU : mobile control unit
AUDIO-EQUIPMENT : equipment like mic/speaker, handset
OP-TERMINAL : terminal for operators
EMERGENCY EQU. : equipment like emergency receiver, emergency button

2.1 Terminal interface

Asynchronous, serial data transmission. Permitted transmission rates are 600, 1200, 2400, 4800 and 9600 Baud. However, for "masc" type terminals 600 baud is not permitted. Default value is 1200 Baud. In MCU it must be possible to set any of these baud rates by hardware switches or alike. It must be possible to set the baud rate of each output separately. Normally 1 start bit, 8 data bits, 1 stop bit and no parity is used. However, masc type terminals should use 7 data bits and even parity.

2.1.1 Printer/data collection unit

Interface designed to connect a printer or any other character (text) oriented terminal. It can also be used for data collection units. This interface must be combined with one or more of the other terminal interfaces. The 7 most significant bits are coded according to MOBITEK TEXT CODE, see reference RI-06. The eighth bit is set to logical zero.

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2.1.2 Terminal with small display

Designed for connection to a unit with a limited text display area and from which the operator can enter numbers, status messages and text including simple text editing. The editor is placed in MCU. Also the audio equipment and the manual mode of the radio equipment can be handled from this unit. Character oriented format (as above) is used.

2.1.3 ANSI terminal

For connection of asynchronous full screen terminal which complies with terminal interface ANSI X 3.41 1964 and ANSI X 3.64 1979 with respect to cursor control and editing functions.

From the terminal the operator can enter numbers, status messages and text including text editing. The editor is placed in MCU. Character oriented format as above.

2.1.4 "MASC" type terminal

Connection of units with the capacity to handle complete data packets (MPAK), e.g. a personal computer. The format is block oriented which means that information is transmitted in the form of packets (MPAK) according to the format which is given in the network layer specification. Control of the complete mobile terminal, e.g. audio equipment and manual mode, is performed by special commands included in the protocol. The interface also contains functions for reading status parameters in the mobile terminal (meant for the type test). 7 bits per character and even parity to be used. Permitted transmission rates are 1200, 2400, 4800 or 9600 Baud.

For type testing, a masc type interface is required. In this case it may be implemented by external adaptors.

2.2 Audio interface

Connection of microphone and loudspeaker or handset. The interface also contains certain control functions. The handset can be combined with numeric and status keys. The same character codes as for the terminal with small display are used. The audio interface can also be combined with the terminal interface. Refer also to the application examples.

2.3 Emergency interface

Connection facilities for four units. Three connections are for emergency buttons and one is for a receiver for receiving emergency transmissions generated by a portable transmitter. Any of these units can initiate the emergency procedure in MCU.

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3 TERMINAL INTERFACE

This chapter describes the interface to equipment which communicates with MCU in serial form.

3.1 PHYSICAL INTERFACE

The physical interface is the same for all terminal types.

The terminal interface uses a 25-pole DSUB socket (female socket with pins) with the following configuration:

PIN	V.24/V.28	V.10 category 1/V.11	SOURCE
1	supply ground	supply ground	
2	transmitted data	transmitted data	A DTE
3	received data	received data	A MCU
4	*	*	
5	*	*	
6	data set ready	data set ready	A MCU
7	signal ground	signal ground	
8	*	data terminal ready B	DTE
9	system start (ground)	system start (ground)	DTE
10	system start (+12V)	system start (+5V)	DTE
11	*	*	
12	*	*	
13	*	*	
14	*	transmitted data	B DTE
15	*	received data	B MCU
16	*	*	
17	*	*	
18	*	data set ready	B MCU
19	*	*	
20	data terminal ready	data terminal ready A	DTE
21	*	*	
22	ring ind.	ring ind.	MCU
23	*	*	
24	-12V (supply)	*	MCU
25	+12V (supply)	+5V (supply)	MCU

* = reserved

Note: Pins 9, 24 and 25 differ from V.28: Pins 9, 10, 24 and 25 differ from V.24.

The following applies to V10: 0 or ON is when A > B and 1 or OFF is when B > A.

The following applies to V28: 0 or ON is when V > 3V and 1 or OFF is when V < -3V.

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Pin:

- 2,3 The transmission rate for serial data is 600, 1200, 2400, 4800 or 9600 baud.
- 6 The signal "DATA SET READY" is activated as soon as MCU is ready to transmit. The signal to be activated when it is not used.
- An active signal means that the physical layer is in the data transmission mode.
- 9 System Start, activating MCU from equipment not according to V.28.
MCU starts up within 10 seconds when pin 9 is activated (ON condition). MCU then remains on until all system start signals are inactivated.
ON condition: voltage 0V - +1V; current less than 5 mA.
OFF-condition: not connected or voltage +2V - +15V; current less than 5 mA.
- 10 System Start, activating MCU by signal according to V.28.
MCU starts up within 10 seconds when pin 10 is activated. MCU then remains on until all system start signals are inactivated.
ON condition: voltage > 3V (see V28).
OFF condition: not connected or voltage < -3V. (see V28).
- 20 The signal "DATA TERMINAL READY" is activated as soon as the terminal is ready to receive. The signal is to be activated when not used.
- An active signal means that the physical layer is in the data transmission mode.
- 22 The signal "RING INDICATION" is used to activate the peripheral unit.
- 24 - 12 V/100 mA supply for connected equipment.
- 25 + 12 V (+ 5 V)/500 mA supply for connected equipment.

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3.2 PROTOCOL FOR PRINTER/DATA COLLECTION UNITS

General

Interface designed to connect a printer or any other character (text) oriented terminal. It can also be used for data collection units. This interface must be combined with one or more of the other terminal interfaces.

Receiving text

To stop the data stream from MCU temporarily, the printer sends XOFF (DC3) to MCU and to restart the data stream it sends XON (DC1).

Sending text

Text can be sent to MCU. In MCU a complete MPAK will be created with sender and addressee before it is transmitted on the radio path.

The connected unit stops sending when it has received XOFF (DC3) from MCU and does not start again until XON (DC1) is received.

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3.3 PROTOCOL FOR TERMINALS WITH SMALL DISPLAY

3.3.1 Receiving data

To stop the data stream from MCU temporarily, the terminal sends XOFF (DC3) and to restart the data stream it sends XON (DC1). Received characters in the code range 32 - 126 (decimal) are printed out directly. Other codes are interpreted by the terminal according to the following table:

CHARACTER CODE	TERMINAL'S INTERPRETATION OF CHARACTER
000	NUL -
001	SOH -
002	STX -
003	ETX -
004	EOT -
005	ENQ -
006	ACK -
007	BEL give audible signal
008	BS move cursor one step to left
009	HT -
010	LF line feed
011	VT -
012	FF -
013	CR move cursor to beginning of line
014	SO -
015	SI -
016	DLE -
017	DC1 resume sending data
018	DC2 -
019	DC3 stop sending data
020	DC4 -
021	NAK -
022	SYN -
023	ETB -
024	CAN -
025	EM -
026	SUB -
027	ESC carry out function as defined below
028	FS -
029	GS -
030	RS -
031	US -
127	DEL -

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SEQUENCE	FUNCTION WHEN RECEIVED
<ESC>[Ax	place the cursor at position x
<ESC>[Bx	insert character x at cursor position
<ESC>[Cx	delete character at cursor and insert character x at end of line
<ESC>[Dx	delete character at cursor and insert character x at beginning of line
<ESC>[E	send user information
<ESC>[H	send display size
<ESC>[M	restart of terminal from MCU
<ESC>[N	display visible <CR>
<ESC>[O	display visible <LF>
<ESC>[P	LED1: on (contact with system)
<ESC>[Q	(green) blinking (no contact with system)
<ESC>[R	off (power off)
<ESC>[S	LED2: on (external call ind. on)
<ESC>[T	(orange) blinking (no function)
<ESC>[U	off (external call ind. off)
<ESC>[Y	LED3: on (Manual radio mode)
<ESC>[Z	(yellow) blinking (Call indication man. mode)
<ESC>[[off (MOBITEX)

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3.3.2 Sending data

The terminal stops when it has received XOFF (DC3) from MCU and does not restart until XON (DC1) is received. All characters are interpreted as when receiving except for the <ESC> sequences defined in the following table:

SEQUENCE	FUNCTION WHEN SENDING
<ESC>OA	place cursor at beginning of text
<ESC>OB	place cursor at end of text
<ESC>OC	move cursor one step to the right
<ESC>OD	move cursor one step to the left
<ESC>OE	user information follows (2048 octets)
<ESC>OHxy	display size: x=character/line, y=no. of line
<ESC>OK	user information missing
<ESC>OM	send message
<ESC>OP	LINE CONNECTION start
<ESC>OQ	STATUS
<ESC>OR	EMERGENCY
<ESC>OW	TELEX
<ESC>OX	DATEX
<ESC>O1	copy
<ESC>Om	lock
<ESC>On	LINE CONNECTION end
<ESC>Oo	external call indication on/off (toggle)
<ESC>Op	TEXT
<ESC>Oq	increase audio volume
<ESC>Or	decrease audio volume
<ESC>Os	loudspeaker on/off (toggle)
<ESC>Ot	cancel
<ESC>Ou	TELEPHONE
<ESC>Ov	MANUAL RADIO MODE

When the terminal is sending, the character DEL (decimal 127) is interpreted as the terminal wishing to remove the character to the left of the cursor.

Following ASCII codes are used to control MANUAL RADIO mode:

Q	channel number where x=channel number 01 - 99
W X	channel number where x=channel number 01 - 99
E	squelch on/off (toggle)
R xxxxxxx	selective call to xxxxxxx, x = 0 - 9
T	transmit call tone
Y	loudspeaker on/off (toggle)
U	scanning
I	external call indication on/off (toggle)

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3.4 PROTOCOL FOR ANSI TERMINAL**3.4.1 Receiving data**

To stop the data stream from MCU temporarily, the ANSI terminal sends XOFF (DC3) and to restart the data stream it sends XON (DC1). Received characters in the code range 32 - 126 (decimal) are displayed directly. Other codes are interpreted by the ANSI terminal according to the following tables:

CHARACTER CODE	ANSI terminal's interpretation of character
000	NUL -
001	SOH -
002	STX -
003	ETX -
004	EOT -
005	ENQ -
006	ACK -
007	BEL give audible signal
008	BS move cursor one step to the left
009	HT -
010	LF line feed
011	VT -
012	FF -
013	CR carriage return
014	SO -
015	SI -
016	DLE -
017	DC1 resume sending data
018	DC2 -
019	DC3 stop sending data
020	DC4 -
021	NAK -
022	SYN -
023	ETB -
024	CAN -
025	EM -
026	SUB -
027	ESC carry out function as defined below
028	FS -
029	GS -
030	RS -
031	US -

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SEQUENCE	FUNCTION WHEN RECEIVING
<ESC>[A	cursor up one step
<ESC>[B	cursor down one step
<ESC>[C	cursor right one step
<ESC>[D	cursor left one step
<ESC>[c	restart of terminal from MCU
<ESC>[0q	switch off LED1--LED4 (not ANSI)
<ESC>[1q	switch on LED1 (not ANSI)
<ESC>[2q	switch on LED2 (not ANSI)
<ESC>[3q	switch on LED3 (not ANSI)
<ESC>[4q	switch on LED4 (not ANSI)

For the meaning of LED1 - LED3 see terminal with small display.

If additional functions are required, we recommend the use of functions and control sequences in accordance with ANSI X 3.41 1974 and ANSI X 3.64 1979...

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3.4.2 Sending data

The ANSI terminal stops sending when it has received XOFF (DC3) from MCU and does not restart until XON (DC1) is received. All characters are interpreted as when receiving, except for the <ESC> sequences defined in the following table:

SEQUENCE	FUNCTION WHEN SENDING
<ESC>OA	move cursor up one step
<ESC>OB	move cursor down one step
<ESC>OC	move cursor one step to the right
<ESC>OD	move cursor one step to the left
<ESC>OE	-
<ESC>OF	-
<ESC>OG	-
<ESC>OHxy	display size: x=character/line,y=no. of lines
<ESC>OI	-
<ESC>OJ	-
<ESC>OK	user information missing
<ESC>OL	-
<ESC>OM	send message
<ESC>ON	-
<ESC>OO	-
<ESC>OP	LINE CONNECTION start
<ESC>OQ	STATUS
<ESC>OR	EMERGENCY
<ESC>OS	-
<ESC>OT	-
<ESC>OU	-
<ESC>OV	-
<ESC>OW	TELEX (not in ANSI standard)
<ESC>OX	DATEx (not in ANSI standard)
<ESC>OY	-
<ESC>OZ	-
<ESC>O[-
<ESC>O\	-
<ESC>O]	-

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SEQUENCE	FUNCTION WHEN SENDING
<ESC>0a	-
<ESC>0b	-
<ESC>0c	-
<ESC>0d	-
<ESC>0e	-
<ESC>0f	-
<ESC>0g	-
<ESC>0h	-
<ESC>0i	-
<ESC>0j	-
<ESC>0k	-
<ESC>0l	copy
<ESC>0m	lock
<ESC>0n	LINE CONNECTION and
<ESC>0o	external call indication on/off (toggle)
<ESC>0p	MOBITEX, start sending message
<ESC>0q	increase volume
<ESC>0r	decrease volume
<ESC>0s	loudspeaker on/off
<ESC>0t	cancel
<ESC>0u	TELEPHONE
<ESC>0v	scroll up presentation field
<ESC>0w	scroll down presentation field
<ESC>0x	get next message
<ESC>0y	-
<ESC>0z	-
<ESC>0{	-
<ESC>0	-
<ESC>0}	-

When the terminal is sending the character DEL (decimal 127) is interpreted as the terminal wishing to remove the character to the left of the cursor.

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3.5 PROTOCOL FOR "MASC" TYPE TERMINALS

The masc type interface is designed for connection of units with the capacity to handle complete data packets (MPAK see reference RI-09), e.g. a personal computer. Information is transferred between the terminal and MCU in the form of frames, described in subsequent clauses. Control of the complete mobile terminal, e.g. audio equipment and manual mode, is performed by special commands included in the protocol. The interface also contains functions for reading status parameters in the mobile terminal (meant for the type test).

For type testing, a masc type interface is required. In this case it may be implemented by external adaptors. For the type testing, only the basic commands and the type testing commands are required.

A frame is formed as a message packet with unique characters marking the beginning and the end of the frame. Sending may be initiated from both sides. The information frame must be acknowledged with ACK before the next information frame is sent.

The characteristics of the protocol are:

- All characters are coded into the 7 least significant bits and bit 8 is used for even parity.
- The error control is done by longitudinal and character parity check and frame length control,
- Transparent data can be sent in hex coded data fields.
- The protocol permits full duplex.

3.5.1 Frame structure

Communication takes place in the form of frames. There are two types of frames, information frames and control frames. The information frames are used to transfer commands and other information. The control frames are used to control the information frame flow.

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The Information frames are divided into the following fields
 (number of octets stated below):

start	length	text	std.	data	check	end
1	4	1-256	1	0-1120	2	1

The Control frames are divided into the following fields
 (number of octets stated below):

start	type	sequ	end
1	1	0-1	1

The maximum frame size permitted is set up by the B-command.
 The maximum possible size is 1150 octets. This means that an
 Information frame can not have the maximum length in all
 fields.

- Start

The start of a frame is denoted by the character ^ with code
 136/94/5E in octal/decimal/hexadecimal notation.

All characters received before the start character should be
 ignored. Every start character is the beginning of a new frame.

- Length

The size of the frame, in number of octets, should be written
 in this field with the ASCII codes of four hexadecimal digits.
 The least significant digit should always be written in octet
 4.

The size of the frame includes all octets including start and
 end characters.
 Permitted characters of length field: 0-9, A-F.

- Text

Text is a field which determines the meaning and the
 interpretation of the frame. The interpretation of the text
 field is carried out by a higher layer. The text field consists
 of at least 1 character and a maximum of 256 characters.
 Numeric information, e.g. command parameters, are always to be
 given as the ASCII codes of the corresponding hexadecimal
 digits 0-F.
 Permitted characters of text field are:
 SPACE (40/32/20) to } (175/125/7D) except Std(:) and
 startcharacter(^).

Booklet:

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- Std (start data)

Text and data are separated by the character : (colon 72/58/3A). Std should be stated even if the data field is empty.

- Data

The data field consists of data.
The coding of the data field is carried out in hexadecimal code so that transparent data can be sent. Each octet of data which is to be coded into the data field is divided into two half octets with four bits in each. Each of these four bit groups is then represented in the data field by the ASCII code of the corresponding hexadecimal digit 0-F. Thus each input octet is represented by two characters (octets) in the data field.

The data field consists of maximum 1120 characters.
Permitted characters of data field is: 0-9, A-F.

- Check

Longitudinal checksum created by exclusive OR on all characters starting with the start character and ending with the character before the checkfield. The check field consists of two ASCII coded hexadecimal digits with the least significant digit in octet 2.

Permitted characters for the check field is: 0-9, A-F

- Type

The type of control frame is stated with one character. The characters which may be used are * (52/42/2A), ? (77/63/3F), ! (41/33/21), # (43/35/23) or & (46/38/26).

- Sequ (sequence number)

The sequence number for ACK-frames. The sequence number can be one of the characters 0 (60/48/30), 1 (61/49/31) or - (minus, 55/45/2D).

- End

The frame is terminated with the carriage return character (CR, 15/13/0D). A frame which is not ended with the end character should be ignored.

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3.5.2 Information frame

Messages are sent as Information frames with an expected acknowledgement (ACK).

The text field of an Information frame has the following general structure:

com	SP	par
>=1	0-1	>=0

com is the command or function code.

SP is the space character (ASCII code 40/32/20 in octal/decimal/hexadecimal notation) which separates the command from the parameters.

par is the ASCII coded parameters or data.

A command which sets parameter A to 587 can be coded in the following ways (all commands are terminated with CR):

```

^0010S A=587:50
^0012SET A/587:D1
^0010S A:028BAF      028B is hex code for 587
^000FSA:028B78       SA is a command
  
```

Note: The textfield can only consist of one (1) command.

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3.5.3 Control frames

The protocol consist of the following control frames:

- ACK
- NACK
- RACK
- SENS
- SACK

- ACK (Acknowledgement of a correct received frame)

Structure:

^	*	sequ	CR
1	1	1	1

ACK means that the received Information frame is correct. A correct frame should comply with the following:

- starts with the start character (^)
- contains only one colon (:)
- the fields "check" and "length" have the correct values
- only permitted characters in text and data fields
- no characters with parity error
- the permitted number of characters has not been exceeded in any individual field or in the complete frame.
- ends with the end character (CR)

The field "sequ" (sequence number) should alter between ASCII character 0 and ASCII character 1 for each frame sent, except when repeating the latest ACK on a RACK request. Then the same value as before is sent again. The first time an ACK is sent "sequ" should be the character 0. If a RACK is received before any ACK has been sent, the field "sequ" will be filled with the character - (minus). "Sequ" with the value of - (minus) is only used when RACK is received before ACK has been sent the first time.

- NACK (No acknowledgement of an incorrect received frame)

Structure:

^	?	CR
1	1	1

NACK is to be sent if the conditions for sending ACK are not fulfilled and the Information frame:

- starts with the start character (^)
- contains only one colon (:)
- has a total length of 10 characters or more
- ends with the end character (CR)

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Should the criteria not be fulfilled for sending ACK or NACK, no reply will be given. The frame will then be repeated by the timeout function in the sending unit.

If the receiving unit cannot handle the incoming data flow, NACK may be used to limit the flow.

- RACK (Request for repetition of the latest sent ACK).

Structure:

^	I	CR
1	1	1

RACK, request for repetition of the latest sent ACK, is sent when no reply on the Information frame has been received within 10 seconds. The receiver of RACK is to reply by repeating ACK with the latest sequence number (sequ) used.

- SENS (link layer control)

Structure:

^	#	CR
1	1	1

SENS is used to control the communication link when there is no traffic. The sender decides when SENS will be sent. Time between 2 SENS should be at least 10 seconds.

When sending a SENS a reply (SACK) will be received within 10 seconds. If no reply is received within 10 seconds, a new SENS will be sent. When two SENS have been sent and no reply is received or no info-frame has been correctly transmitted, the communication link is supposed to be broken. A restart will be done by sending a B-frame.

If SACK is received and no SENS has been sent, the SACK will be ignored.

- SACK (Sens acknowledgement)

Structure:

^	&	CR
1	1	1

SACK will be sent when a controlframe (SENS) has been received. It should be sent at the first possible opportunity when nothing else is being sent.

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3.5.4 Flow control and error handling

If the reply of an Information frame is ACK, the Information frame will be correctly received. The field "sequ" is saved as the latest received sequ number.

If the reply is a NACK, the Information frame will be repeated.

If there is no reply within 10 seconds after the Information frame was sent, a RACK will be sent. If there is no reply on the RACK, a new RACK will be sent every 10 seconds. If no ACK has been received within 30 seconds after the Information frame was sent (time-out), higher layers will be notified. However, the repetition of RACK will continue until interrupted by higher layers or by the fact that an ACK has been received.

When an ACK is received as a reply to a RACK, the sequ number of this ACK will be compared with the stored sequ number of latest received ACK. If the numbers are equal, the Information frame was not received and must be repeated. If the numbers are different, the Information frame was received correctly (but ACK was lost) and the Information frame should not be repeated. However, if the sequ number of the received ACK is - (minus) the Information frame must be repeated.

When the physical layer gets into datatransmission mode the link layer is supposed to start up.

When one of the two interconnected units is started up, it has no stored value of the sequ of the latest received ACK. Neither does it have a value of the sequ of the latest sent ACK. To handle this situation and to prevent a possible doubling of the first frame, the following start up procedure is required:

- The first Information frame sent should be a B-frame. This B-frame consists of communication parameters for maso protocol (see appendix A).
- If the sending of that B-frame leads to error handling with RACK, the B-frame must be repeated regardless of the value of the sequ field of the ACK response to RACK.

The actions to be taken when receiving ACK as a response to RACK are summarized in the following table:

sequ of the latest received ACK	sequ of received ACK			
	-		1	
	0	1	0	1
none	repeat	repeat	repeat	repeat
0	repeat	repeat	repeat	no rep.
1	repeat	no rep.	repeat	repeat

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Communication is on a full duplex line. This means that a message stream can be in progress in both directions at the same time. Both parties may send an Information frame independently of each other and an Information frame may therefore be received when a control frame is expected (ACK/NACK). However, the next incoming frame will then be a reply as each Information frame is to be acknowledged before a new one is sent. The minimum time between these two frames will be the time set by the int (interval) parameter of the B-command (minimum time between the sending of two subsequent frames).

Blattort

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3.5.5 Time diagram

0. MCU/terminal starts up by setting protocol parameters.
1. MCU sends Information frame 0 to terminal which sends acknowledge.
2. MCU sends Information frame 1 which is disturbed and then repeated after NACK from terminal.
- 3.0 MCU sends Information frame 2 but it does not reach the terminal the first time. Information frame repeated after NACK and repeated ACK being the same as previous ACK (sequ=0).
- 3.1 The same as 3.0 but this time ACK(1) does not reach the sender. RACK is sent and now the repeated ACK, having a new sequ, indicates that the frame was received correctly.
4. MCU and terminal sending Information frames at the same time.
5. MCU and terminal doesn't start at the same time.
- 5.5 MCU restarts and B-frame is repeated.

(Number in brackets after ACK denotes sequence number)

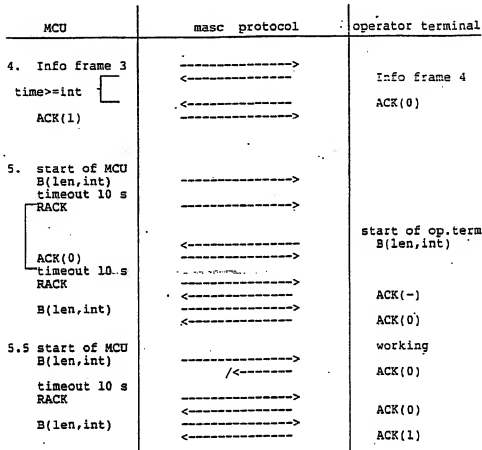
MCU	masc protocol	operator terminal
0. B(len,int)	----->	
	<-----	ACK(0)
ACK(0)	<-----	B(len,int)
	----->	
1. Info frame 0	----->	
	<-----	ACK(1)
2. Info frame 1	-----X----->	
	<-----	NACK
Info frame 1	----->	
	<-----	ACK(0)
3.0 Info frame 2	----->/	
timeout 10 s	----->	
RACK	<-----	ACK(0)
Info frame 2	----->	
	<-----	ACK(1)
3.1 Info frame 2	----->	
	/<-----	ACK(1)
timeout 10 s	----->	
RACK	<-----	ACK(1)

Blackout

Reproo

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No. 1056 - A 296 5175/3 Use
System Date 1990-02-23 Ver. A P. File MTS19.3



Bildzeit

Diagramm

A 292 5153-3

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Rev. A
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4 AUDIO INTERFACE

This interface is intended for the connection of audio equipment such as microphone and loudspeaker or a handset. The interface also contains certain control functions.

A simple audio equipment can consist of a loudspeaker and a microphone or a handset with holder and switches to activate the functions needed (hook on/off, push-to-talk). The handset can also be a more complex unit using serial data to communicate over the interface and including a small display and numeric and status keys. Some examples are given in application examples.

4.1 PHYSICAL INTERFACE

The terminal interface uses a 15-pole DSUB socket (female socket with pins) with the following configuration:

PIN	SIGNAL	ACTIVE	SOURCE
1	ground for earphone/loudsp		MCU
2	data send		audio equipment
3	data receive		MCU
4	extern. call indic. on/off	on = 0V	audio equipment
5	volume up	up = 0V	audio equipment
6	volume down	down=0V	audio equipment
7	ground for control signals		MCU
8	system start	start=0V	audio equipment
9	+12V		MCU
10	-12V		MCU
11	microphone LF		audio equipment
12	microphone ground		
13	microphone hook on/off	lifted=0V	audio equipment
14	transmit/receive switch	transm.=0V	audio equipment
15	earphone/loudspeaker LF		MCU

pins:

2,3 Data send/receive
V24/V28 applies.
Data is formatted in accordance with "terminal with small display".

4 External call indication on/off
When pin 4 is activated, MCU toggles the external call indication on/off. When on, the external call indicator (e.g. horn) is activated when a message is received.

Handset

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pins:
5,6

Volume up/down

Grounding pin 5 or 6 will adjust the audio level (volume) of the loudspeaker or the earphone, whichever is active when the pin is activated. (The audio level of the inactive unit will remain as before.) The adjustment is made in steps, one step for each new activation of the pin. If the pin is activated continuously, the level to be adjusted by one step per second. The lowest level possible to set must still be noticeable.

8

System start

MCU will start up within 10 seconds when pin 8 is activated. It then remains on until switched off by other means even if the pin is inactivated.

9,10

Power supply of connected equipment

+12V (pin 9) is able to supply a current of at least 500 mA and -12V (pin 10) a current of at least 100 mA.

11,12

Microphone input

Input impedance: 10 kohm.

Sensitivity: An input signal with the frequency 1 kHz and a level of 100 mV produces an RF deviation of 3.0 kHz. This level is produced by the microphone at a sound pressure of 94 dB above $2 \cdot 10^{-5}$ pascal.

13

Microphone hook on/off

When the microphone of handset is lifted from its holder, pin 13 is activated (HOOK OFF signal generated). If a handset with earphone is used, the loudspeaker will be inactivated and the earphone activated. When the microphone or handset is placed in its holder again, pin 13 will be inactivated (HOOK ON signal generated). If an earphone has been used, it will be inactivated and the loudspeaker activated (for audio level settings, see pin 5,6).

14

Transmit/receive switch

When activated, the radio unit will transmit and when deactivated, the radio unit will receive (push-to-talk switch).

1,15

Earphone/loudspeaker

This output is able to support impedances down to 4 ohms.

Earphone sensitivity: The earphone produces a sound pressure of 85-95 dB above $2 \cdot 10^{-5}$ pascal when driven by a signal with the frequency 1 kHz and a level corresponding to an RF deviation of 3.0 kHz.

Bottom

Repeat

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5 EMERGENCY INTERFACE

5.1 PHYSICAL INTERFACE

The terminal interface uses a 15-pole DSUB socket (female socket with pins) with the following configuration:

PIN	SIGNAL	ACTIVE	SOURCE
1	emergency 1	emerg=0V	emergency equip.
2	emergency ACK	ACK =0V	MCU
3	emergency_ack. from fixed	emack=0V	MCU
4	emergency_ack. ACK	ACK =0V	emergency equip.
5	*		
6	emergency 2	emerg=0V	emergency equip.
7	ground for control signal		
8	system start	start=0V	emergency equip.
9	+12V (supply)		MCU
10	*		
11	emergency 3	emerg=0V	emergency equip.
12	emergency 4	emerg=0V	emergency equip.
13	emergency LP input		emergency equip.
14	emergency LP ground.		emergency equip.
15	external indicator	on = 0V	MCU

* = reserved

pins:

1 Emergency 1
Emergency alarm from an external emergency unit, e.g. a receiver for emergencies sent on radio from a pocket transmitter. Emergency 1 (pin 1) is used together with pin 8 (system start) and pin 2 (emergency ACK from MCU) to be able to initiate an emergency alarm even if MCU is powered off. When the external emergency unit initiates the alarm, it activates both pin 1 (emergency 1) and pin 8 (system start). After detecting the alarm, MCU sends an acknowledge to the emergency unit by activating pin 2 (emergency ACK from MCU). The emergency unit must keep pins 1 and 8 activated until this ACK has been received. MCU will then create and send a SOS packet to the network.

2 Emergency ACK from MCU
Emergency ACK is an acknowledgement from MCU that emergency 1 has been received by MCU (response to activation of pin 1).

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- 3 Emergency acknowledgement from fixed terminal
 When the Fixed terminal has received the emergency message (SOSINFO), it can send a special emergency acknowledge packet (SOSACK) or a request for an emergency connection (SOSCONREQ) addressed to the alarming subscription. When a SOSACK is received by MCU, it indicates this to the emergency unit by grounding pin 3. The emergency unit in turn grounds pin 4 as an acknowledgement.
 Additional reactions from MCU when receiving SOSACK or SOSCONREQ are very much depending on application. A parameter emergency-acknowledge-status should be implemented and stating at least the following:
 status = 0 no additional reaction
 1 activate external indication (e.g. horn)
 2 emergency line connection in direction mobile to base (one-way, mobile transmitting)
 3 send acknowledge to op. terminal
- 4 Emergency acknowledgement ACK from emergency unit
 Used by the emergency unit to acknowledge the activation from MCU of pin 3.
- 6,11,12 Emergency 2, 3 and 4
 These pins are intended for initiating an emergency alarm from simple emergency equipment such as a single push button. When one of these pins is activated, MCU creates a SOS packet and sends it to the network. Should the pin remain active, the time between repeated SOS packets must be at least 1 minute. The signals are not acknowledged by MCU.
- 8 System start
 MCU will start up within 10 seconds when pin 8 is activated. It then remains on until switched off by other means even if the pin is inactivated.
- 9 Power supply for external equipment
 +12V is able to supply a current of at least 500 mA. (The emergency unit should always be powered up)
- 13,14 Emergency LF input (for emergency connection)
 Input impedance: 10 kohm.
 Sensitivity: An input signal with the frequency 1 kHz and a level of 100 mV produces an RF deviation of 3.0 kHz. This level is produced by the microphone at a sound pressure of 94 dB above 2*10⁻⁵ pascal.
- 15 Activation of external indicator
 This pin is used to activate an external indicator (e.g. horn). It is able to sink at least 100 mA to operate e.g. a relay which activates the horn (open collector output).

Signature

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5.2 Time diagram:

EMERGENCY UNIT (emergency 1):

packet	radio path	RADIO/MCU	interface	em. unit
		start	<--- 8	start up
		emergency 1	<--- 1	emerg.1
SOS	<-----	emergency ACK	2 --->	ack
		send emergency signal		
		(external indicator		
		might be activated	15 --->	horn)

IN CASE OF MANUAL ACKNOWLEDGE FROM FIXED TERMINAL AFTER RECEIVING SOSINFO

SOSACK	----->	emerg._ack from fixed	3 --->	fixd ack
		acc. to em.ack.status	<--- 4	ack
		(e.g. ext. indicator	15 --->	horn)

EMERGENCY BUTTON (emergency 2, 3 or 4):

packet	radio path	RADIO/MCU	interface	em.butt.
		emergency 2 (3 or 4)	<--- 6	emerg.2
SOS	<-----	send emergency signal		
		(external indicator		
		might be activated	15 --->	horn)

IN CASE OF MANUAL ACKNOWLEDGE FROM FIXED TERMINAL AFTER RECEIVING SOSINFO

SOSACK	----->	emerg._ack from fixed	3 ---/	
		acc. to em.ack.status	15 --->	horn)
		(e.g. ext. indicator		

Binders

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Series Date
1990-02-23

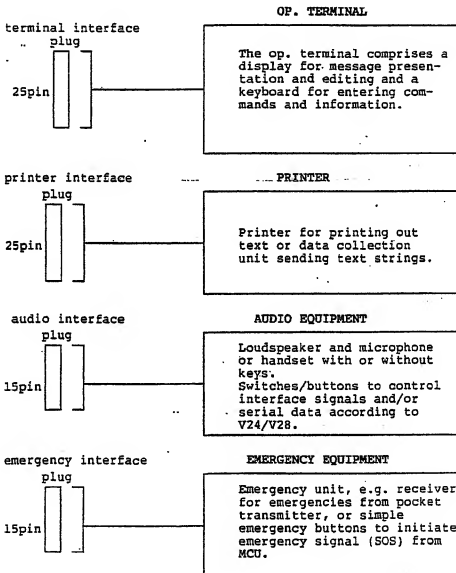
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6 APPLICATION EXAMPLES

The interfaces can be used in a variety of ways depending on the application. Below are some examples given.

The terminal equipment can be connected to these interfaces.



Bildtext

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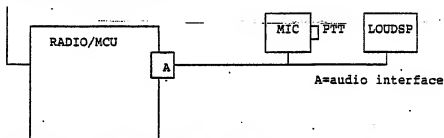
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The following examples are described:

1. Microphone/loudspeaker
2. Handset with numeric and function keys
3. Handset with numeric and function keys, printer
4. Microphone/loudspeaker, control unit, printer
5. Op. terminal with small display, loudspeaker, printer
6. Op. terminal of ANSI type, microphone/loudspeaker, data collection unit
7. PC, microphone/loudspeaker
8. PC, handset with keys, printer, emergency equipment
9. PC, microphone/loudspeaker, control unit, printer, emergency equipment

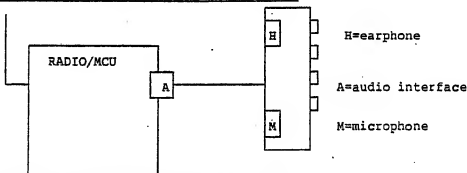
(PTT = push-to-talk button)

1. Microphone/loudspeaker



Is able to send/receive speech. (Sends only to default receiver)

2. Handset with numeric and function keys



Is able to send/receive status and speech.

Buildings

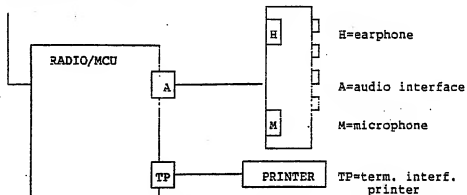
Repro

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Cantel Mobitex

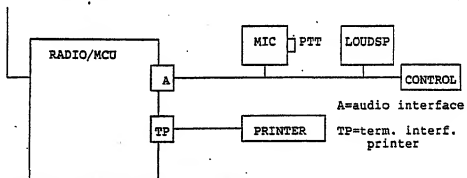
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3. Handset with numeric and function keys, printer



Is able to send/receive status and speech and to receive text.

4. Microphone/loudspeaker, control unit, printer



Is able to send/receive status and speech and to receive text.

Bildzeit

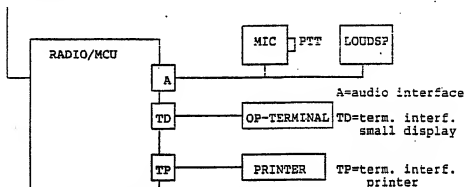
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Cantel Mobitex

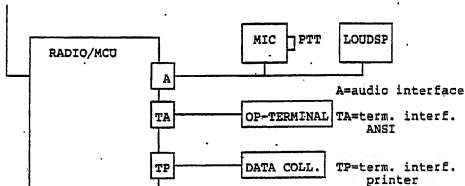
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5. Op. terminal with small display, microphone/loudspeaker, printer



Is able to send/receive text, status and speech.

6. Op. terminal of ANSI type, microphone/loudspeaker, data collection unit.



Is able to send/receive text, data, status and speech. Data can be controlled and collected over radio in the form of text strings to and from the data collection unit.

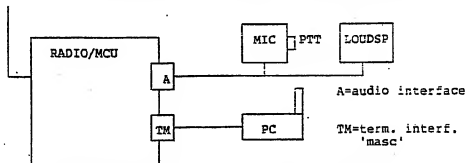
Bildschirm

Reprint

Cantel Mobitex -

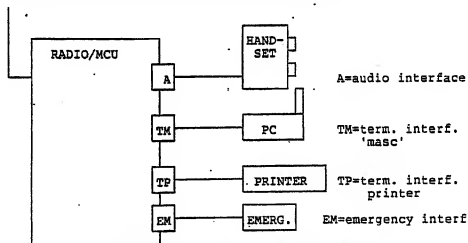
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7. Personal computer as terminal, microphone/loudspeaker



Is able to send/receive text, data, status and speech.

8. Personal computer as terminal, handset with numeric and function keys, printer, emergency equipment



Is able to send/receive text, data, status, speech and emergency.

Booklet

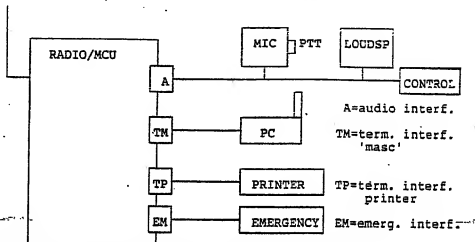
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9. Personal computer as terminal, microphone/loudspeaker, control unit, printer, emergency equipment



Is able to send/receive text, data, status, speech and emergency.

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7 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 4
R1-09, 16

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

Blockout

Approved

A 292 51530

DOCUMENTATION

REQUIREMENT SPECIFICATION 1(47)

Contract Reference ET/SYS PES	Exchangeable - System Requirements ET/SYS PES	No. No. 2/1056 - A 296 5175/2 Ue	
Document/Contract - System/Requirement ET/SYSC STT <i>STT</i>		Date Date 1990-02-26 A	Rev. Rev. MTS19A.2
Description Cantel Mobitex		Title MOBITEX Terminal Specification Mobitex ASynchronous Communication APPENDIX A, Commands	
<p><u>ABSTRACT</u></p> <p>This document specifies commands in the interface MOBITEX ASynchronous Communication(MASC) used between an application and a mobile terminal.</p>			
<p>Bidchart</p> <p>Regres</p>			

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Booklet

Report

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Date Issued
1990-02-26Rev
AFile No.
MTS19A.2**1 INFORMATION FRAME COMMANDS AND FUNCTIONS IN MOBILE TERMINAL**

The commands, questions and replies available as information frames in MASC are summarized below and a description is given on the following pages.

1.1 BASIC FUNCTIONS

The following commands are always to be implemented in MCU.

B	parameters for the MASC protocol
M	send/receive MPAK via radio
E	error command or function
N	return of MPAK that has not been sent
R	return of incorrect MPAK
D	route received MPAKs to an output
S	send MPAK to the specified output
T	request or transfer of emergency text
U	send emergency signal (SOS-packet)
F P	terminal subscription MAN request and answer
F Q	device handling the MASC protocol
F F	MCU in contact with Mobitex network
F G	MCU has no contact with Mobitex network
F H	MCU inform that MPAK has been sent over the radio
F K	Error message from MCU
F O	Prepare to close down MCU
F #	Short number list request and answer

 Bildtext

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 File Name MTS19A.2

1.2 TYPE TEST FUNCTIONS

The following commands are always to be implemented in MCU.

These functions should only be used during type testing and must be made inoperative for normal use.

All requested parameters which are available in the mobile should be included in all answers to type test functions.

Type test functions consist of commands belonging to specific radio protocol.

To separate mobile terminals with different radio protocol, the following commands are available:

P-command	Used in mobile terminal at 1200bps.
K-command	Used in mobile terminal at 1200bps.
PA-command	Used in mobile terminal at 8/16kbps.
KA-command	Used in mobile terminal at 8/16kbps.

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1.3 TERMINAL SYSTEM FUNCTIONS

The following commands to be implemented in MCU, according to application.

F system control

1.4 AUDIO FUNCTIONS

The following commands to be implemented in MCU, according to application.

A controlling audio functions

1.5 MANUAL RADIO FUNCTIONS

The following commands to be implemented in MCU, according to application.

E controlling manual radio mode

1.6 USER COMMANDS

The following commands are free to use in applications. If used in application, contact mobile manufacturer about implementation in MCU.

X
Y
Z

Bridgeport

Seaside

A 297 5155/2

Cantel Mobitex -

Sc. No.	2/1056 - A 296 5175/2 Ue
Serial Data	1990-02-26 A
Rev	MTS19A.2

2 BASIC FUNCTIONS (always to be implemented in MCU)

2.1 B-command (parameters for the MASC protocol)

Structure of text field:

B	SP	len	,	int
1	1	3	1	1-4

The data field is empty.

The B-command is used to set parameters for the protocol.

len is a 3-digit ASCII coded hex number which sets the maximum length of an information frame. This field should always be set to the maximum possible frame size, i.e. 47E (1150 decimal).

int is a maximum 4-digit ASCII coded hex number which sets the shortest time between two subsequent frames. The value is given in 10 ms increments. Default value is int = 0.

len and int are separated by a , (comma).

These parameters should be used as soon as they have been received.

The default values are used until a B-command has been received. A B-command should be the first frame sent after start up.

After receiving a B-command, the protocol should send a start of line signal to a higher protocol, to make clear that the connection is established and that the start sequence can follow.

Start of line signal is an internal signal between the link layer and higher layer.

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2.2 M-command (send/receive MPAK via radio)

Structure of text field:

M	SP	sequ-id
---	----	---------

1 1 1
SP indicate that a sequence number identity is added. If no SP then there is no sequ-id.

sequ-id is a 1-digit ASCII coded decimal number between 0 - 9. This sequence number is an identity of the MPAK.

Structure of data field:

MPAK
16-1120

MCU receiving the M-command sends MPAK via the radio path to the network. If M-command consists of a sequence number, the command FH indicating 'sent to mobitex network' is sent to terminal including the sequence number. Returned MPAK should also indicate sequence number.

MPAK received via the radio path, is sent over the interface to the terminal with the M-command (MAN is included in MPAK). The sequence number is not used in this M-command.

The received MPAK(to be sent via the radio path) should be a permitted MPAK concerning valid information in the MPAK head and MPAK length(sender, trafstate, class, packet type, size of MPAK).

Description of the different MPAKs can be found in " Network layer for terminals", see reference R1-09.

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2.3 E-command (Error command or function)

Structure of text field:

E

1

The datafield may be used to send information about the error.

The E-command informs that the previously received command or function cannot be executed. (Command or function is not implemented in the receiving unit or included parameters are not accepted).

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2.4 N-command (return of MPAK not sent)

Structure of text field:

N	SP	err-code	,	sequ-id
---	----	----------	---	---------

1 1 2 1 1
 SP indicate that an error code and sequence number are added. If no SP then there is no error code or sequence number.

err-code is a 2-digit ASCII coded hex number between 00 - FF. This error code is described in chapter "Fault situation in mobitex mobile stations".

sequ-id is a 1-digit ASCII coded decimal number between 0 - 9. This sequence number is an identity of the MPAK.

Structure of data field:

MPAK
16-1120

The N-command indicates to the terminal that the MPAK has not been sent over radio (communication failure or transmission interrupted by FO or FI-command).

In manual mode MPAK's should be returned by the N-command.

The MCU can indicate the reason, of not sending the MPAK over the radio, by adding the error code.

If a sequence number is indicated in the M-command, then this sequence number should also be in the N-frame.

If no error code or sequence number is valid, this parameter is not added.

Description of the different MPAKs can be found in " Network layer for terminals", see reference RI-09.

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2.5 R-command (return of incorrect MPAK)

When receiving the R-frame and not finding the fault, the receiving unit is supposed to make a restart by sending a B-frame.

Structure of text field:

R	SP	err-code	,	sequ-id
---	----	----------	---	---------

1 1 2 1 1
 SP indicate that an error code and sequence number are added. If no SP then there is no error code or sequence number.

err-code is a 2-digit ASCII coded hex number between 00 - FF. This error code is described in chapter "Fault situation in mobitex mobile stations".

sequ-id is a 1-digit ASCII coded decimal number between 0 - 9. This sequence number is an identity of the MPAK.

Structure of data field:

 MPAK
 16-1120

MCU uses the R-frame to return an MPAK which was received with the M-command and which does not comply with the format and the rules set by the network and link layers of MOBITEK terminals.

The MCU can indicate the reason, of not accepting the MPAK, by adding the error code.

If a sequence number is indicated in the M-command, then this sequence number should also be in the N-frame.

If no error code or sequence number is valid, this parameter is not added.

Description of the different MPAKs can be found in " Network layer for terminals", see reference R1-09.

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2.6 D-command (route received MPAKs to an output)

Structure of text field:

D	SP	MAN	,	UTG	,	TYP	,	SET
1	1	6	1	1	1	1	1	1

The data field is empty.

MAN is a 6-digit ASCII coded hex number stating the MAN for which MPAKs are to be routed to output UTG. MAN must be one of the possible MANS of the terminal (terminal MAN, group MAN or personal MAN).

UTG is a 1-digit ASCII-coded hex-number stating the output to which received MPAKs are to be routed.

TYP is a 1-digit ASCII-coded hex-number stating the type of MPAK which is to be routed to UTG.

SET is activating the function of set/reset these parameters.

UTG and TYP to be used as follows:

UTG = 0 default output
 1 printer
 2 audio
 3 emergency
 4 op. terminal:1 (MASC protocol)
 5 op. terminal:2
 6 op. terminal:3
 7 op. terminal:4
 8 op. terminal:5
 9 op. terminal:6

TYP = 0 no types(reset all)
 1 text
 2 data
 3 status
 4 line connection (speech)
 5 emergency
 6 all types except emergency
 7 extpak
 8 hpdata
 9 dteserv

SET = 0 set these parameters
 1 reset these parameters

Bitdata:

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After receiving the D-command, MCU will route incoming MPAKs of the specified type and intended for the specified MAN to the function block which handles the communication (formatting etc) for the specified output. Thus it is possible to route MPAKs to several outputs e.g. to both printer and op.terminal.

When receiving a D-command with UTG="default output", the MCU resets all earlier D-commands for the specified MAN and specified TYP. If for example the TYP is "all types", all earlier D-commands concerning this specified MAN are reset and all types are sent to default output connection. If TYP is "no types", then all types is reset for this MAN and UTG.

It is possible to set or reset an earlier D-command, using the parameter set or reset.

After logout, a personal subscription should be removed from this list of routing MPAKs.

When power on, MCU sets up default outputs, e.g. text, data and status to op.terminal and line connection to audio interface.

All MPAK:DTESEV is routed to output, where terminal MAN is located (can be more than one).

Description of the different MPAKs can be found in " Network layer for terminals", see reference R1-09.

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2.7 S-command (sends MPAK to the specified output)

Structure of text field:

S	SP	UTG
1	1	1

Structure of data field:

MPAK
16-1120

UTG is a 1-digit ASCII-coded hex-number which states to which output MPAK is to be sent.

When receiving the S-command, MCU sends MPAK to the output stated by UTG.

The parameter UTG is to be used as follows:

UTG = 0	direct to default output
1	printer
2	audio
3	emergency
4	op. terminal:1 (MASC protocol)
5	op. terminal:2
6	op. terminal:3
7	op. terminal:4
8	op. terminal:5
9	op. terminal:6
A	
B	
C	
D	
E	
F	printer, without printing the MPAK-head

Note 1: When the parameter UTG = F, the datafield consists of printable information except the MPAK-head. The printer should ignore the MPAK-head, this means that the information starts in octet 12.

Description of the different MPAKs can be found in "Network layer for terminals", see reference R1-09.

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2.8 T-command (request/transfer of emergency text).

Structure of text field, request:

T

1

Structure of data field for transfer of emergency text:

Emergency text

0 - 256

The T-command is used by the terminal to set up in MCU the dynamic text part of the emergency signal and as a request to MCU to return the stored emergency text. MCU uses the command as a reply to the request.

The emergency text field is the emergency text which is to be transferred. The emergency text can have up to 256 characters according to MOBITEK textcode. The first two octets of the text part are reserved to indicate the source of the emergency.

Source of emergency:

Emergency 1	= 01
Emergency 2	= 02
Emergency 3	= 03
Emergency 4	= 04
Handset	= 05
OP-terminal 1	= 06

When receiving a T-command with text part, MCU stores emergency text as the dynamic text part of a possible, future SOS packet. When receiving the T-command request, the stored emergency text is sent to the terminal by the T-command with text part.

Description of the emergency packets and procedures (SOS, SOSINFO etc) can be found in "Network layer for terminals", see reference R1-09.

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2.9 U-command (send emergency signal SOS)

U

1

The U-command is used by the terminal to initiate the transmission of an emergency signal (SOS packet).

When receiving the U-command, MCU creates a SOS packet and sends it to the network. The text part of SOS is made up by the stored emergency text (received earlier by the T-command) where the identity of the emergency source is inserted as the first two octets.

Description of the emergency packets and procedures (SOS, SOSINFO etc) can be found in "Network layer for terminals", see reference R1-09.

When MCU is in manual mode, it is recommended that the MCU return to MOBITE^X operating mode and sends the packet MPAK:SOS.

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2.10 F P-command (MAN request)

The FP-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.11 F Q-command (device handling the MASC protocol)

The FQ-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.12 F F-command (MCU in contact with mobitex)

The FF-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.13 F G-command (MCU not in contact with mobitex)

The FG-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.14 F H-command (MPAK sent over radio path)

The FH-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.15 F K-command (error message from MCU)

The FK-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.16 F O-command (prepare to close down)

The FO-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

2.17 F #-command (short number list)

The F#-command is described in chapter TERMINAL SYSTEM FUNCTIONS F-command.

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3 TYPE TEST FUNCTIONS (always to be implemented in MCU)

These functions should only be used during type testing and must be made inoperative for normal use.

3.1 P-command (request/list of parameters)

Structure of text field in request for internal parameters from terminal to MCU:

P
1

Structure of text field in reply from MCU to terminal (list of parameters):

P SP list-of-parameters
1 1 >=1

The data field is empty.

The P-command is used by the terminal to request radio protocol parameters and by MCU to send these parameters as a reply to the request.

The list of parameters consists of a number of ASCII coded hex numbers separated by , (comma). The parameters to be sent in the following order:

Parameter	No. of bytes
Slot length	1
Timeout short	1
Timeout long	1
Free slots	1
Rand slots	1
Current base (internal parameters in MCU)	2
Chosen slot (internal parameters in MCU)	1
Max access	1
Max rep	1
Priority (internal parameter in MCU)	1
Sequential number up (term.MAN)	1
Sequential numbers down (term.MAN+15 groups)	16
Upfreq (current)	2
Downfreq (current)	2
Flexlist (MAN 1 - 7)	21
Grouplist (MAN 1-15)	45

The meaning and structure of the different parameters can be found in "Data link layer for terminals", see reference R1-16.

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3.2 PA-command (request/list of radio-parameters)

Structure of text field in request for internal parameters from terminal to MCU:

PA01

4

Structure of text field in reply from MCU to terminal (list of parameters):

PA01 SP list of parameters

4

1

>=23

The data field is empty.

The PA-command is used by the terminal to request radio protocol parameters and by MCU to send these parameters as a reply to the request.

The list of parameters consists of a number of ASCII coded hex numbers separated by , (comma). If a parameter is not available or not given, this parameter is not included. The parameters to be sent in the following order:

Parameter	No of bytes
Timeout	1
Slot_length	1
Free_slots	1
Rand_slots	1
Max_rep	1
Max_access	1
Max_speech	1
Txpow	1
Slev1	1
Slev2	1
Scan_time	1
Bad_base	1
Good_base	1
Choose_base	1
Better_base	1
Qpos	1
Current_base (internal parameter in MCU)	2
Chosen_slot (internal parameter in MCU)	1
Priority (internal parameter in MCU,current value)	1
Upfreq (current value)	2
Downfreq (current value)	2
Access_channel upfreq (current value)	2
Access_channel downfreq (current value)	2
Network_id (mobile tx)	2
Network_id (mobile rx)	2
Area_id	1

Bitstart

Repeat

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Example of PA01-command:

MCU

TERMINAL

PA01

PA01 01,02,03,04,05,06,07,08,09,10,11,12,13,14,15,16,0017,
18,19,0020,0021,0022,0023,0024,0025,26

OR

PA01 01,02,03,04,,,,,,,,,,,,,,,,,,,,,26

The meaning and structure of the different parameters can be found in "Data link layer for terminals", see reference R1-16.

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3.3 PA-command (request/list of identity-parameters)

Structure of text field in request for identity parameters from terminal to MCU:

PA02

4

Structure of text field in reply from MCU to terminal (list of parameters):

PA02 SP list of parameters

4

1

>=40

The data field is empty.

The P-command is used by the terminal to request radio protocol parameters and by MCU to send these parameters as a reply to the request.

The list of parameters consists of a number of ASCII coded hex numbers separated by , (comma). If a parameter is not available or not given, this parameter is not included. The parameters to be sent in the following order:

<u>Parameter</u>	<u>No of bytes</u>
Terminal MAN	3
ESN	4
Flexlist (MAN 0 - 7)	21
Group list (MAN 1-15)	45
Sequential number up (term.MAN)	1
Sequential numbers down (term.MAN+15 groups)	16

Example of PA02-command:

```

MCU                                TERMINAL
      <----- PA02
PA01 000001,00000002,000003,000004,000005,,,,,000010,,,,
      ///////////////26,27/////////////////42
      <----->
  
```

The meaning and structure of the different parameters can be found in "Data link layer for terminals", see reference R1-16.

Bildart

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3.4 PA-command (request/list of channel-parameters)

Structure of text field in request for parameters from terminal to MCU:

PA03

4

Structure of text field in reply from MCU to terminal (list of parameters):

PA03 SP list of parameters

4 1 >=4

The data field is empty.

The P-command is used by the terminal to request radio protocol parameters and by MCU to send these parameters as a reply to the request.

The list of parameters consists of a number of ASCII coded hex numbers separated by , (comma). If a parameter is not available or not given, this parameter is not included. The parameters to be sent in the following order:

Parameter	No of bytes
Channel list (current)	1
Number Of channels in channel_list (total)	2
Number of channels in this command	1
Channel #1 - upfreq	2
Channel #1 - dofreq	2
Channel #2 - upfreq	2
Channel #2 - dofreq	2

Channel-list = 01(hex) DEFAULT LIST
 02(hex) CURRENT LIST
 03(hex) TEMP_DEFAULT LIST

All parameters in this command is a number of ASCII coded hex number.

Example: Answer with a default list of 100 channels.

PA03 01,0064,3C,0123,0123,.....
 PA03 01,0064,28,0123,0123,.....

The meaning and structure of the different parameters can be found in "Data link layer for terminals", see reference R1-16.

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3.5 PA-command (request/list of roaming-parameters)

Structure of text field in request for parameters from terminal to MCU:

PA05

4

Structure of text field in reply from MCU to terminal (list of parameters):

PA05 SP list of parameters
4 1 >=4

The data field is empty.

The P-command is used by the terminal to request radio protocol parameters and by MCU to send these parameters as a reply to the request.

The list of parameters consists of a number of ASCII coded hex numbers separated by , (comma). If a parameter is not available or not given, this parameter is not included. The parameters to be sent in the following order:

Parameter	No of bytes
Number of bases in table	1
Current_base_id	2
roaming_value	1
Base_id	2
roaming_value	1
.	
.	
.	

Example: Mobile terminal with current_base(23) choosen.

PA05 03,0023,09,0025,02,0019,04

Mobile terminal with no choosen current_base.

PA05 03,,,0023,02,0019,01

The meaning and structure of the different parameters can be found in "Data link layer for terminals", see reference RI-16.

Signature

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3.6 PA-command (request/list of test-parameters)

Structure of text field in request for parameters from terminal to MCU:

PA06	SP	function	,	parameter
4	1	2		>= 0

Structure of text field in reply from MCU to terminal (list of parameters):

PA06	SP	function	,	list of parameters
4	1	2	1	>=1

The data field is empty.

The P-command is used by the terminal to request for radio protocol parameters and by MCU to send these parameters as a reply to the request.

The function is a ASCII coded decimal number between 00 - 99, describing separate request or answer. Those functions are described below.

The list of parameters consists of a number of ASCII coded hex numbers separated by , (comma). If a parameter is not available or not given, this parameter is not included. The parameters to be sent in the following order:

Function:

No:	description:	parameter:
01	current_base(Req/ans)	in the answer, the current_base is in ASCII coded hex number.
02	set current_base	Current base in ASCII coded hex number.
03	disable base search mode	-
04	enable base search mode	-
05	clear dynamic memory	-
06	enable copy REPMAP when receiving or sending the frame <REB>	An ASCII coded hex number for each bit set to "1" indicating repetition in the frame <REB>. A comma is placed between each number.
07	disable copy REPMAP	-
08	enable loudspeaker	-
09	disable loudspeaker	-

Blockers

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No: **description:**
10 copy NUMRET

parameter:
The parameter NUMRET in ASCII coded hex number, stating the number of retransmissions.

- 11 enable transmitting the scrambling signal over the radio(see ref R1-17) -
- 12 disable transmitting the scrambling signal over the radio(see ref R1-17) -
- 13 copy speech parameters.

Subscriber, con-id, upfreq, dofreg. Parameters in ASCII coded hex number separated by a comma.

Example: MCU

Terminal

PA6 01,1234

<----- PA6 01

<----- PA6 02,1234

PA6 06,6,23,35

<----- PA6 06

<----- PA6 07

<----- PA6 08

<----- PA6 09

PA6 10,12

<----- PA6 10

<----- PA6 12

<----- PA6 11

PA6 13,123456,12,1111,2222

<----- PA6 13

The meaning and structure of the different parameters can be found in "Data link layer for terminals", see reference R1-16.

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3.7 K-command (receive/transmit frequency number)

Structure of text field to frequency number reception:

KM	SP	parameter
2	1	3

Structure of text field to frequency number transmission:

KS	SP	parameter
2	1	3

The data field is empty in both commands.

The parameter field states the frequency number. The number is given as the ASCII codes of the hexadecimal digits of the frequency number in hexadecimal notation.

The K-command is used to set up the frequency pair to be used for reception and transmission. The frequency number range is hexadecimal 001 - 617 (decimal 0001 - 1559).

If the frequency number included in the frame is not implemented in the equipment, MCU will respond with an E-frame (error function).

For correspondence between frequency number and frequency, see reference RI-06 .

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3.8 KA-command (receive/transmit frequency number)

Structure of text field to frequency band:

KAB	SP	FBI
-----	----	-----

3 1 1

Structure of text field to frequency number reception:

KAM	SP	parameter
-----	----	-----------

3 1 4

Structure of text field to frequency number transmission:

KAS	SP	parameter
-----	----	-----------

3 1 4

The data field is empty in all commands.

The parameter FBI states the frequency band and bitrate. The parameter is given as the ASCII coded hex number of the parameter FBI in upfreq and dofreq.

The parameter field states the frequency number. The number is given as the ASCII codes of the hexadecimal digits of the frequency number in hexadecimal notation.

The KA-command is used to set up the frequency pair to be used for reception and transmission. The frequency number range is hexadecimal 0001 - 1FFF (decimal 0001 - 8191).

If the frequency number included in the frame is not implemented in the equipment, MCU will respond with an E-frame (error function).

For correspondence between frequency number and frequency, and frequency band(FBI) and bitrate, see reference R1-06.

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4 TERMINAL SYSTEM FUNCTIONS (implemented according to application)

4.0 F-command (system control)

The F-command is used from op. terminal to execute the specified function in MCU.
 The F-command is used by MCU to send information to the terminal.

Structure of the text field:

F	SP	list of parameters
1	1	>=1

The data field is used only in the FT- and F#-frame with list of channel numbers and short numbers.

The list of parameters is a list of one-character function codes and parameters in ASCII code according to the following table:

- 4.1 F B Change to MOBITEK operation mode
MCU sends an ACTIVE packet to the network
- 4.2 F C Set up a MOBITEK line connection
parameters MAN1,MAN2
MAN is a 6-digit ASCII-coded hex-number.
MAN1=sender, MAN2=addressee.
MCU creates and sends a CONREQ packet to the network.
- 4.3 F D Set up a TELEPHONE line connection
Parameters MAN,TEL
MAN is a 6-digit ASCII-coded hex-number (sender).
TEL is the desired number in the telephone network.
The number is given in MOBITEK textcode, right justified in a 20 character field with leading spaces according to the corresponding field of EXTCONREQ.
MCU creates and sends an EXTCONREQ packet to the network.
- 4.4 F E Disconnect line connection
MCU creates and sends a DISCON packet to the network.
- 4.5 F F Contact with the MOBITEK network
MCU is in contact with the MOBITEK network.
- 4.6 F G No contact with MOBITEK network
MCU has no contact with the MOBITEK network and is trying to establish contact again (roaming procedure started).

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- 4.7 F H MPAK sent by the radio to the network
Parameter SEQU-ID
MCU inform that MPAK has been sent to the network.
The parameter SEQU-ID is added if SEQU-ID was included in the M-command. SEQU-ID is a 1-digit ASCII coded decimal number between 0 - 9.
- 4.8 F I Cancell previously transmission of MPAK
Previously activated transmission of MPAK is cancelled. The MPAK to be returned to the terminal by an N-frame.
- 4.9 F J Print out current MANs in terminal
Print current MANs in terminal on printer (terminal subscription MAN, group MANs (group list) and personal subscription MANs (flex_list) in that order.
- 4.10 F K Error message about a fault situation
Parameter XX
Error message where XX is the error number in ASCII coded hex digits 00-FF (0-255).
Information from MCU about a fault situation. Description of the meaning fault situation see chapter "Fault situation in mobitex mobile stations".
- 4.11 F L Activate external call indication
Activate external indication (e.g. horn) for 2 seconds.
- 4.12 F M Transmitter on/off
Parameter X
X = character 0 ----> transmitter off
X = character 1 ----> transmitter on
- 4.13 F N Change to MANUAL RADIO mode
MCU sends an INACTIVE packet to the network.
- 4.14 F O Prepare for closing down MCU
From terminal: Command to prepare closing down (switching off) the MCU.
MCU clears buffers for stored MPAKs. MPAKs to be transmitted to the network are transmitted. All other MPAKs are sent to the terminal. If no contact with the network, MPAK's to the network are returned by the N-command.
Then MCU sends an INACTIVE packet to the network. Finally MCU confirms that it is empty by sending a FO-frame to the terminal.
From MCU: MCU is empty and ready to be switched off.

Note: If more than one device connected, the FO-command from the MCU should be sent to all devices.

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4.15 F P Terminal MAN request/answer
Request from terminal for terminal subscription MAN.

F PXXXXXX Terminal subscription MAN from MCU to terminal as response to the request.
XXXXXX is the MAN as a 6 digit ASCII coded hex number.

4.16 F Q MASC device identity
Parameter XXX
Type of device handling the MASC protocol.
F Q(MASC_DEVICE) is information to other units connected to this MASC interface.
XXX = MCU
XXX = MOX

4.17 F R Change network identification
Parameters XXXX,YYYY
Send this new network identification to data link layer(see reference R1-16).
XXXX = is new network ID for mobile tx in ASCII coded hex number.
YYYY = is new network ID for mobile rx in ASCII coded hex number.

4.18 F S Change AREA-LIST
Parameters BITMAP,COM
Send this new area list to data link layer(see reference R1-09 and R1-16).
BITMAP = see AREALIST reference R1-09.
COM = see Command reference R1-09.
Parameters BITMAP and COM is in ASCII coded hex digits.

4.19 F T Change TEMP DEFAULT LIST
Parameters TNUM,NUM,M
Send this new channel list to data link layer(see reference R1-09 and R1-16).
TNUM = Total number of channels. If TNUM is zero, delete TEMP DEFAULT LIST and return to DEFAULT LIST.
NUM = Number of channels in this command
M = 0 No more channels
M = 1 More channels in next command.
Parameters TNUM, NUM and M is in ASCII coded hex digits.
The list itself is sent in the data field of the frame. The list is described in reference R1-16.

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4.20 F V Speech queue information
Parameter XX
Information about queue-position when waiting for speech to be connected.
XX is the speech-queue number in ASCII coded hex digits in the range 00-FF.

4.21 F # Short number list
Request from terminal for short number list.

F #XX
List of short numbers from MCU or terminal. The list contains short numbers which are common to MCU and all connected terminals (general short numbers). It is sent by the terminal to set up this list and by MCU as a reply to the F# request frame from the terminal.
XX is the number of short numbers in the list in ASCII coded hex digits in the range 00-32 (0-50 decimal).
The list itself is sent in the data field of the frame. In the list, the actual numbers corresponding to each short number from 1 and up are given as ASCII coded digits with a maximum of 20 digits each. The numbers are separated by the character , (comma).

NOTE: Only the 'one-character function' can be included in an F-command, e.g. F P123456.

Description of the different packets and procedures mentioned here can be found in reference R1-09 and R1-16.

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Diagram

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1990-02-26 A MTS19A.2

5 AUDIO FUNCTIONS (implemented according to application)

5.0 A-command (controlling audio functions).

Structure of text field:

A	SP	list of parameters
---	----	--------------------

1 1 >=1

The data field is empty.

The A-command is used to control the audio equipment.

The list of parameters is a list of one-character function codes and parameters in ASCII code according to the following table:

- 5.1 A B Increase audio volume level
- 5.2 A C Decrease audio volume level
- 5.3 A D Loudspeaker on/off
Parameter X
X = character 0 --> off
X = character 1 --> on
- 5.4 A E External call indication on/off
Parameter X
X = character 0 --> off
X = character 1 --> on
- 5.5 A H Microphone (hook) on/off
Parameter X
X = character 0 --> off
X = character 1 --> on
- 5.6 A I Transmit/receive switch
Parameter X
X = character 0 --> transmit
X = character 1 --> receive
- 5.7 A J Hands free.
Parameter X
X = character 0 --> off
X = character 1 --> on
- 5.8 A V Audio level order.
Parameter X
X=data, ASCII coded hex digit 0-F.

NOTE: Only the 'one-character function' can be included in an A-command, e.g. A E0.

Buttons

Repeat

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6 MANUAL RADIO MODE FUNCTIONS (implemented according to application)

6.0 H-command (controlling manual radio mode)

Structure of text field:

H	SP	list of parameters
1	1	>=1

The data field is empty.

The H-command is used to control the radio equipment when in manual radio mode.

The list of parameters field is a list of one-character function codes and parameters in ASCII code according to the following table:

- 6.1 H A Change to MOBITEK mode.
MCU sends an ACTIVE packet to the network.
- 6.2 H B Increase audio volume level.
- 6.3 H C Decrease audio volume level.
- 6.4 H D Loudspeaker on/off.
Parameter X
X = character 0 --> off.
X = character 1 --> on.
- 6.5 H E External call indication on/off.
Parameter X
X = character 0 --> off.
X = character 1 --> on.
- 6.6 H F Call indication
Parameter X
X = character 0 --> no call received
X = character 1 --> call received
- 6.7 H G Squelch open/closed (toggle).
- 6.8 H H Microphone (hook) on/off.
Parameter X
X = character 0 --> off.
X = character 1 --> on.
- 6.9 H I Transmit/receive switch
Parameter X
X = character 0 --> transmit
X = character 1 --> receive

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Rev	A
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- 6.10 H J Hands free.
Parameter X
X = character 0 --> transmit
X = character 1 --> receive
- 6.11 H K Change to channel number.
Parameter XX
Change to channel number XX where XX is the desired channel number in ASCII coded hex digits in the range 01-63 (1-99 decimal).
- 6.12 H L Channel number indication.
Parameter XX
XX is the channel number in ASCII coded hex digits in the range 01-63 (1-99 decimal). Will be sent when start up or a changed channel occur.
- 6.13 H M Send selective call number.
Parameter XXXXXXXX
Send selective call number XXXXXXXX on current channel.
X is an ASCII coded digit 0-9.
If the number of digits is less than 7, the number will be left justified and the XXXXXXXX-field will be filled with trailing spaces (hex code 20).
- 6.14 H N Scan the specified channels.
Parameter XX..XX
XX..XX is a list of maximum 8 channel numbers in a field of 16 octets. Each XX represents a channel number in ASCII coded hex digits in the range 01-63 (1-99 decimal). If the number of channels is less than 8, the field will be filled with trailing spaces (hex code 20).
The specified channels are scanned for carrier or selective call.
- 6.15 H O Carrier indication.
Parameter X
The frame must be transmitted only when there is a change between sensing carrier and sensing no carrier. The carrier sense itself should be updated at least once per second.
X = character 0 --> no carrier
X = character 1 --> carrier
- 6.16 H P Copy of own selective number.
Parameter XXXXXXXX
Copy of the own selective call number.
X is an ASCII coded digit 0-9.
If the number of digits is less than 7, the number will be left justified and the XXXXXXXX-field will be filled with trailing spaces (hex code 20).
- 6.17 H Q Transmit/receive indicator
Parameter X

Buildings

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X = S ---> transmitting (sending)
X = M ---> receiving (monitoring)

Note: Only the 'one-character function' can be included in an H-command, e.g. H P1234567.

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7 Signalling between MCU and terminal equipment connected to the MASC interface.

7.0 General

These chapters have been included because the network layer may be differently implemented in different terminal equipment. For any terminal equipment, connected to MCU via the MASC interface, the MCU can be considered as a DCE for connection to the MOBITEIX network. A terminal can have a complete MOBITEIX network layer or a simplified network layer, using different commands of the MASC protocol.

A terminal connected to the MCU must have the same terminal MAN number as the MCU.

The terminal MAN must be associated to at least one output connection, either a MASC interface or another connection (e.g. a handset or a printer).

All messages to groups, belonging to terminal MAN, should be directed to the same output connection(s) as terminal MAN.

The MCU has the responsibility towards the MOBITEIX network according to the network layer.

In order to get the MOBITEIX network layer in MCU and the terminal to interact correctly, the following chapters have to be considered.

7.1 MPAK received from the network

ROAMORD, FLEXREQ, INFOREQ and ESNREQ will be completely handled within the MCU without notifying any connected terminal.

DIE and LIVE will be completely handled within the MCU but notified by FK-command(if handled) to connected terminals.

All other correctly received MPAKS will, after normal handling in the MCU, be sent to the output connection where the addressed MAN is located.

A fixed terminal can't receive a CONORD, therefore CONORD is to be converted to a CONREQ by the MCU.

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7.2 MPAK received from a terminal

Normally, if the MPAK passes the checks in the MCU, the MPAK will be sent to the network. The MCU should react and enter states as if the MPAK was generated in the MCU (e.g. on CONREQ the MCU should enter a state for call in progress, and should also act according to the radio protocol for sending such MPAK).

If the checks fail, the MPAK should be returned to the terminal by an R-frame.

For the following MPAK's, however, the MCU should have a special treatment.

CONREA	to be treated as a hook off-signal
DISCON	to be treated as a hook on-signal
FLEXREQ	if the personal subscription already exist in flexlist the terminal will be informed by FK-frame.
FLEXLIST	to be returned to the terminal by an R-frame.
BORN, ROAM, INFO, ESNINFO	to be returned to the terminal by an R-frame.
LINEON, LINEOFF	to be returned to the terminal by an R-frame.

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7.3 Connection between the MCU and the terminal

The terminal is supposed to have a list of groupMAN's and a list of personal subscriptions (flexlist). In order to get the lists in the MCU equivalent to the list in the terminal, the following should be considered.

Each time the link layer connection is established (by exchange of B-frames), the terminal will send:

- MANREQ (command F P) to request MCU for the terminal MAN

To answer this, the MCU sends the terminal MAN in the command MAN (command F P). This answer should be sent immediately or, if another frame is currently being transmitted by the MCU, immediately after the transmission is completed. After that, the MCU will send the MASC_DEVICE command (F Q).

The MCU should send:

- GROUPLIST to set the list of groupMAN in the terminal
- FLEXLIST to set the flexlist in the terminal.

The terminal will then handle the flexlist according to the specification, see R1-09.

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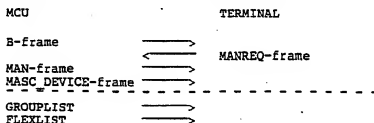
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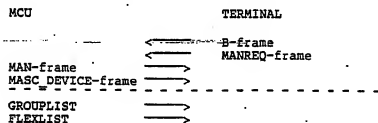
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 Date: 1990-02-26 Rev. A File: MTS19A.2

Example of start sequence when MCU starts.



Example of start sequence when TERMINAL starts:



Note: Packets above the dotted line in each sequence belong to the link layer, and packets below the dotted line belong to the network layer.

7.4 Signalling between MCU and more than one terminal

The MCU may have more than one MASC interface.

All MASC interfaces should have the same start sequence as described in chapter "Connection between the MCU and the terminal".

The MCU handles all MPAKs and messages to different output connections where the MAN is located.

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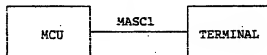
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7.5 Description of a system with MASC interface.

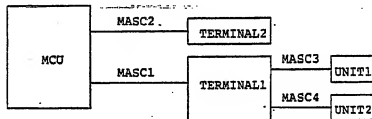
7.5.1 MCU connected to one terminal.



MCU handles the terminal MAN, group MAN and personal MAN with GROUPLIST and FLEXLIST in the start sequence.

After the start sequence, all MPAKs are routed to the terminal.

7.5.2 MCU connected to two terminals.



MCU handles the terminal MAN, group MAN and personal MAN with GROUPLIST and FLEXLIST in the start sequence.

All terminals that have other terminal equipment connected, will have the same start sequence as described in chapter "Connection between the MCU and the terminal". These terminals should be considered as an MCU by the connected units.

After the start up sequence all MPAKs are routed to the current terminal.

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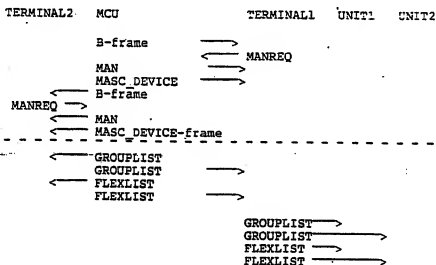
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Examples of start sequences.

EXAMPLE 1.

Lists when MAN are correct and MCU starts.



Note: Packets above the dotted line in the sequence belong to the link layer, and packets below the dotted line belong to the network layer.

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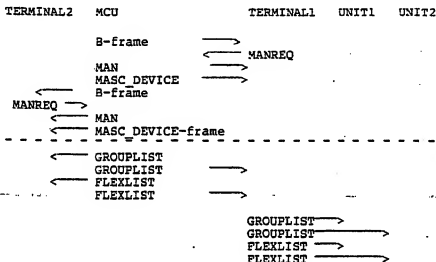
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EXAMPLE 2

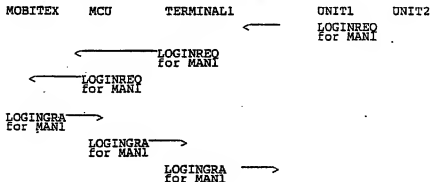
MAN1 is only in UNIT1 and TERMINAL1. MAN2 is only in MCU.
 MAN1 and MAN2 are personal subscriptions not included in MCU's Flexlist.



Note 1: The terminal/unit1/unit2 will replace former lists with these new lists. When replacing the flexlist the terminal/unit1/unit2 will decide if MAN1 and MAN2 are connected or disconnected. If connected, a loginreq is sent from MAN1 in unit1 and a loginreq sent from MAN2 in unit2. If not connected an presentation of the logout is sent to the user.

Note 2: The application in UNIT1 has to send LOGINREQ for MAN1 if it wishes to keep MAN1.

Note 3: Packets above the dotted line in the sequence belong to the link layer, and packets below the dotted line belong to the network layer.



BitError

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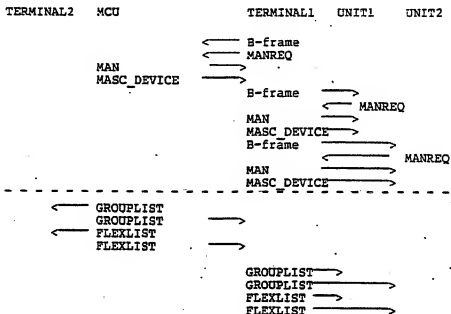
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EXAMPLE 3.

TERMINAL1 is starting the connection.



Note: Packets above the dotted line in the sequence belong to the link layer, and packets below the dotted line belong to the network layer.

Holdout

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7.6 Fault situation in mobitex mobile stations.

This is a recommendation of error message from the MCU to the connected unit using a MASC interface. This error message is a response for a fault situation and sent as an error number in the FK-command (see chapter "Information frame commands and functions").

Error numbers 0 - 4F is reserved for specific meaning. Error numbers 50 - FF is free to use.

New meaning of error numbers is described in R1-06.

Error no: meaning:

0	reserved	
1	DIE mode.	An MPAK:DIE is received. No user traffic can be sent from the MCU.
2	LIVE mode.	An MPAK:LIVE is received..User traffic can be sent from the MCU.
3	SPEECH mode.	The MCU is in speech mode and can not send any traffic except MPAK:CSUBCOM.
4	MANUAL mode.	The MCU is in the manual mode and not in contact with mobitex network.
5	reserved	
6	reserved	
7	reserved	
8	reserved	
9	reserved	
A	Receiver buffer full, waiting for free buffer.	
B	Buffer/memory free.	
C	No memory, waiting for more memory.	
D	reserved	
E	reserved	
F	reserved	

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<h2 style="margin: 0;">Cantel Mobitex -</h2>	No. No 2/1056 - A 296 5175/2 Ue	Date Date 1990-02-26 A	P. - P. A MTS19A.2
	<p>Error no: meaning:</p> <ul style="list-style-type: none"> 10 Returned MPAK during die mode. 11 Returned MPAK during speech mode. 12 Returned MPAK during manual mode. 13 Returned MPAK during buffer full. 14 reserved 15 reserved 16 Loginrequest MAN already exist in the flexlist. 17 Loginrequest MAN is not possible, flexlist is full. 18 MPAK sender MAN is not in TMAN or flexlist. 19 reserved 1A reserved 1B reserved 1C reserved 1D reserved 1E reserved 1F reserved 20 - 4F reserved 		

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8 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

RI-06, 27, 28, 45
RI-09, 9, 11, 12, 14, 15, 16, 17, 31, 32, 39
RI-16, 19, 21, 22, 23, 24, 26, 31, 32
RI-17, 26

Below are the reference designations listed.

Reference	Section
RI-01	Arrangement of the documents
RI-02	MOBITEK System description
RI-03	General description of terminals
RI-04	Terminology
RI-05	References
RI-06	Network operator information
RI-08	Application layer
RI-09	Network layer
RI-11	Interface requirements, fixed terminals
RI-12	Other requirements, fixed terminals
RI-16	Link layer, mobile terminals
RI-17	Physical layer, mobile terminals
RI-18	Radio equipment, mobile terminals
RI-19	Other interfaces, mobile terminals
RI-20	Other requirements, mobile terminals

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REQUIREMENT SPECIFICATION 1(38)

Support - Primary ET/SYS PES	Integrating direct requirement ET/SYS PES	Do No 1/1056 - A 296 5175 Ue
Support - Secondary ET/SYS STT <i>ST</i>		Date 1990-02-23
		Rev B
		File No MTS19B.1
Description CanTel Mobitex		Title MOBITEX Terminal Specification Other interfaces, mobile terminal APPENDIX B, Application example
<p style="text-align: center;">APPLICATION EXAMPLE</p> <p style="text-align: center;">OF HOW TO MAKE AN ALTERNATE CONNECTION VIA MCU FOR FIXED TERMINALS WITH MASC INTERFACE.</p>		

Dissemination

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Cantel Mobitex

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Date: 1990-02-23 Rev. B File: MTS19B.1

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1 INTRODUCTION

This document describes an example (i.e. not a specification) of an MCU application. Its purpose is to make it easier for the manufacturers. For the understanding of this document, the reader has to be well informed about the Network layer for terminals (reference R1-09) and Link layer for mobile terminals (reference R1-16).

A fixed terminal may be directly connected to the MOBITECH network via a masc interface (MASC) see document "Other interfaces" and appendix A "Commands". The application in this document describes how such a terminal may be connected via an MCU, that handles the masc interface. As to the requirements of such a terminal, please refer to chapter 7 in this document.

Subject:

Report:

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2 MCU WITH APPLICATION

Figure 1 shows an MCU with its processes. Each process communicates with the other processes as is indicated by the arrows in the figure.

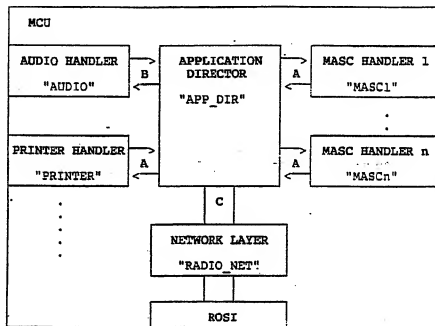


FIGURE 1

In the centre of figure 1 is a process called APP DIR, application director. This document will describe that process.

Each MASC handler (MASC1 to MASCn) handles a masc interface.

The audio handler (AUDIO) handles an audio interface.

The printer handler (PRINTER) handles a printer, connected to the MCU.

Furthermore one may have "emergency handler", "terminal with small display handler" etc.

The network layer (RADIO NET) is a normal MOBITEK network layer for mobile terminal, plus the additions made in chapter 7 (Requirements on network layer in MCU in this application).

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The letters A, B and C represent different signalling sequences. Observe that the MASC handler and the printer handler acts similarly towards the application director. All handlers act in the same way as an MASC handler towards the application director.

Following terms are used in this document:

- line handler common name for all handlers. E.g. MASC1, MASC7, AUDIO ...
- MCU_MAN the mobile terminal's MOBITEK subscription number.

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3 DESCRIPTION OF SIGNALS

All signals that are handled by APP_DIR have the following structure:

origin Original sender. Can be: line handler,
RADIO NET or
APP_DIR.

from Sender. Can be : line handler,
RADIO NET or
APP_DIR.

signal_status Signal status can be signal_status_ok or
signal_status_not_sent.
Signal status is always set to
signal_status_ok when the signal is
created.
If the RADIO NET or any of the line
handlers fails to transmit a signal,
signal status will be set to
signal_status_not_sent. Then the signal
is returned to APP_DIR.

signal_type Can be: S_hook_on,
S_hook_off,
S_MPAK,
S_MPAK_sent_on_radio,
S_returned_incorrect_MPAK,
S_not_sent_MPAK
S_line_up,
S_line_down.

(MPAK) If signal_type is S_MPAK, S_not_sent_MPAK
or S_returned_incorrect_MPAK, it contains
an MPAK in this field.

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Description of the signal types:

S line up

S_line_up is sent by all line handlers to APP_DIR after a correct start or restart.

If the line handler is an MASC handler, the starting up sequence will send a PRIM_MASC_frame and an acknowledgement of this will be received from the connected unit before S_line_up may be sent.

If the line handler is a PRINTER, it is recommended that S_line_up is not sent until the modem signals say there is a printer connected.

S line down

S_line_down is sent by all line handlers to APP_DIR when the unit is disconnected.

If the line handler fails to transmit a signal to the connected unit, S_line_down will be sent to APP_DIR together with the signal being returned.

S MPAK

S_MPAK is the normal signal being sent between line handler and APP_DIR and between RADIO_NET and APP_DIR. In the normal case, signal status is signal status ok. But in the case when line handler or RADIO_NET fails to transmit the signal, signal status will be set to signal status not sent and the signal will be returned to APP_DIR. For further information see examples below (chapter 4).

When an S_MPAK is received by the MASC-handler, the MASC-handler must send an M-frame to the connected unit according to the masc protocol.

When an M-frame is transmitted from the connected unit to the MASC-handler, the MASC-handler must send an S_MPAK to APP_DIR.

S returned incorrect MPAK.

S_returned_incorrect_MPAK is sent by APP_DIR to line handler if an incorrect MPAK was received.

If an MASC handler receives a S_returned_incorrect_MPAK, this MPAK will be sent to the connected Unit in an R-frame according to the masc protocol.

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S not sent MPAK.

S not sent MPAK is sent by APP_DIR to line handler if, for some reason, it is impossible to transmitt a mpak on radio.

If an MASC handler receives a S not sent MPAK, this MPAK will be sent to the connected unit in an N-frame according to the masc protocol.

S MPAK sent on radio

S MPAK sent on radio is sent by RADIO_NET to APP_DIR when an MPAK has been sent via radio. Origin helps APP_DIR to direct this signal to correct line-handler. When the MASC handler receives an S MPAK sent on radio, it uses the masc F_H-frame to send the signal to connected unit.

S hook off

S hook off is sent by AUDIO to APP_DIR at hook off. APP_DIR updates its registers and passes the signal on to RADIO_NET.

An MPAK CONREA, received by APP_DIR from connected unit, will not be sent to RADIO_NET. Instead S_hook_off will be sent from APP_DIR to RADIO_NET.

S hook on

S hook on is sent by AUDIO to APP_DIR at hook on. APP_DIR updates its registers and passes the signal on to RADIO_NET.

An MPAK DISCON, received by APP_DIR from connected unit, will not be sent to RADIO_NET. Instead S_hook_on will be sent from APP_DIR to RADIO_NET.

Bulkout

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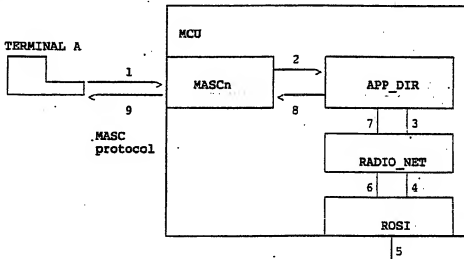
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4 EXAMPLES OF SIGNALLING IN THIS APPLICATION

4.1 EXAMPLE 1: sending TEXT successfully

Unit A sends an MPAK TEXT to a subscriber B in the MOBITEK network. Transmission via radio is successful.



signal	signal_type	origin	from	signal_status
1	masc frame M			
2	S_MPAK	MASCn	MASCn	signal_status_ok
3	S_MPAK	MASCn	APP_DIR	signal_status_ok
4 - 5 are not handled in this document.				
7	S_MPAK sent on radio	MASCn	RADIO NET	signal_status_ok
8	S_MPAK sent on radio	MASCn	APP_DIR	signal_status_ok
9	masc frame F_H			

Observe that origin = MASCn through the whole sequence. This gives APP DIR an opportunity to route signals easier back to the sender.

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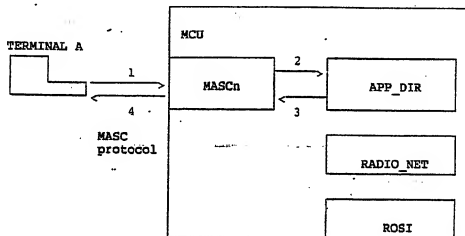
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4.2 EXAMPLE 2: sending TEXT unsuccessfully

Unit A sends an MPAK TEXT to a subscriber B in the MOBITEK network. APP_DIR discovers some kind of error.



signal	signal_type	origin	from	signal_status
1	masc frame M			
2	S_MPAK	MASCn	MASCn	signal_status_ok
3	S_returned-I_incorrect_MPAK	MASCn	APP_DIR	signal_status_ok
4	masc frame R			

Observe that signal 3 has signal status set to signal_status_ok. Only line handlers and RADIO_NET may set signal status to signal_status_not_sent.

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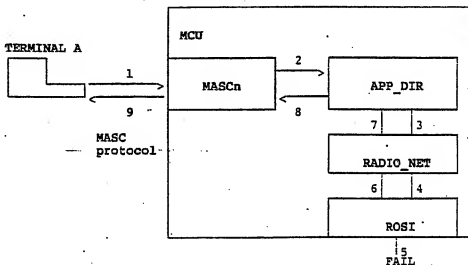
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4.3 EXAMPLE 3: sending TEXT unsuccessfully

Unit A sends an MPAK TEXT to a subscriber B in the MOBITEK network. Transmission via radio fails.



signal	signal_type	origin	from	signal_status
1	masc frame M			
2	S_MPAK	MASCn	MASCn	signal_status_ok
3	S_MPAK	MASCn	APP_DIR	signal_status_ok
4 - 6	are not handled in this document.			
7	S_MPAK	MASCn	RADIO_NET	signal_status-not sent
8	S not sent MPAK	MASCn	APP_DIR	signal_status_ok
9	masc frame N			

Bulldozer

Naples

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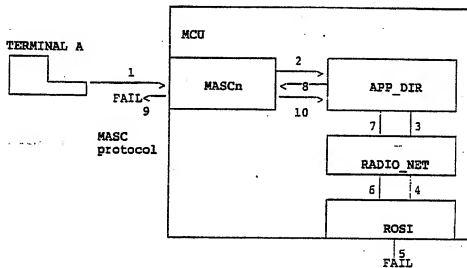
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4.4 EXAMPLE 4: sending TEXT unsuccessfully.

Unit A sends an MPAK TEXT to a subscriber B in the MOBITEK network. Transmission via radio fails. The MCU fails to return the packet to unit A.



signal	signal_type	origin	from	signal_status
1	masc frame M			
2	S_MPAK	MASCn	MASCn	signal_status_ok
3	S_MPAK	MASCn	APP_DIR	signal_status_ok
4 - 6	are not handled in this document.			
7	S_MPAK	MASCn	RADIO_NET	signal_status-not sent
8	S_not_sent_MPAK	MASCn	APP_DIR	signal_status-ok
9	masc frame N			
10	S_not_sent_MPAK	MASCn	MASCn	signal_status-not sent

This sequence is the same as the one in example 3, except for signal 10. When receiving signal 10, APP_DIR discovers that origin = from, i.e. the signal is returned even from the MASC handler. The only thing APP_DIR can do is to forget the signal.

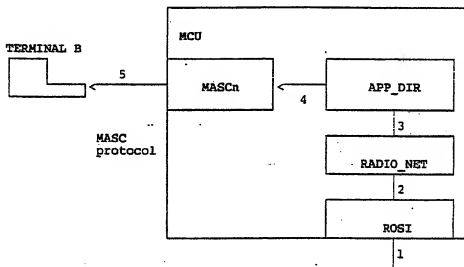
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4.5 EXAMPLE 5: receiving TEXT successfully
MCU receives an MPAK TEXT, addressed to MCU-MAN.



signal	signal_type	origin	from	signal_status
1 - 2		are not handled in this document.		
3	S_MPAK	RADIO_NET	RADIO_NET	signal_status_ok
4	S_MPAK	RADIO_NET	APP_DIR	signal_status_ok
5	masc frame M			

The sequence above is valid if there is only one line handler.

If an MPAK is addressed to the MCU MAN, and there is more than one line handler, APP DIR will send a copy of signal 4 to each one of them. But if the MPAK is addressed to a transferred MAN, APP DIR will know on which of the line handlers this MAN can be reached.

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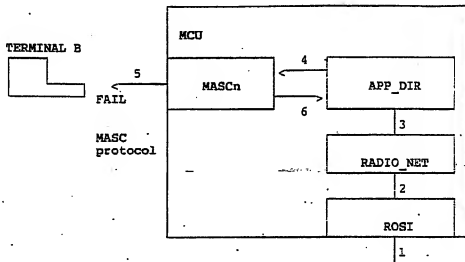
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4.6 EXAMPLE 6: receiving TEXT unsuccessfully

MCU receives an MPAK TEXT to unit B. Transmission to unit B fails. There is only one receiver in this example and MPAK is addressed to MCU_MAN.



signal	signal_type	origin	from	signal_status
1 - 2	are not handled in this document.			
3	S_MPAK	RADIO_NET	RADIO_NET	signal_status_ok
4	S_MPAK	RADIO_NET	APP_DIR	signal_status_ok
5	masc frame M			
6	S_MPAK	RADIO_NET	MASCn	signal_status-not_sent

Observe that an MPAK, addressed to MCU_MAN or any MAN included in the grouplist, must not under any circumstances, be returned to the MOBITEK network. In this application, APP_DIR forgets the MPAK.

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Report

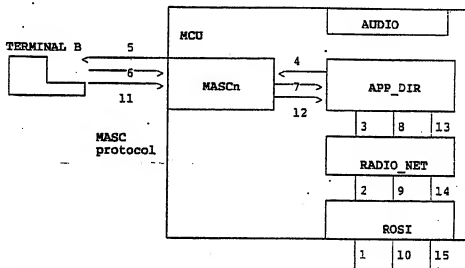
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4.7 EXAMPLE 7: receiving CONREQ

MCU receives an MPAK CONREQ addressed to unit B. Unit B responds with an MPAK CONREA after which the call can begin. Unit B terminates the call by sending an MPAK DISCON.



signal	signal_type	origin	from	signal_status
1 - 2	are not handled in this document.			
3	S_MPAK	RADIO_NET	RADIO_NET	signal_status_ok
4	S_MPAK	RADIO_NET	APP_DIR	signal_status_ok
5	masc frame M			
6	masc frame M			
7	S_MPAK	MASCn	MASCn	signal_status_ok
8	S_hook off	MASCn	APP_DIR	signal_status_ok
9 - 10	are not handled in this document.			
11	masc frame M			
12	S_MPAK	MASCn	MASCn	signal_status_ok
13	S_hook on	MASCn	APP_DIR	signal_status_ok
14 - 15	are not handled in this document.			

Note: signal 1 - 5 contains MPAK CONREQ.
signal 6 - 7, 9-10 contains MPAK CONREA
signal 11 - 12, 14-15 contains MPAK DISCON

In this application S hook on and S hook off are always sent, instead of MPAK DISCON and MPAK CONREA, to the RADIO_NET.

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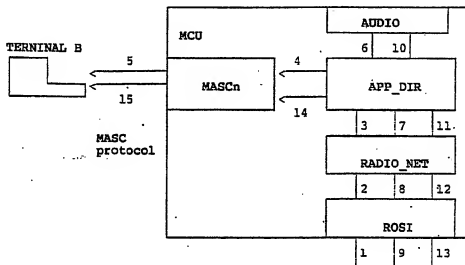
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4.8 EXAMPLE 8: receiving CONREQ

MCU receives an MPAK CONREQ addressed to unit B. The audio interface generates a hook off after which the call can begin. The call is terminated by the audio interface generating an hook on.



signal	signal_type	origin	from	signal_status
1 - 2	are not handled in this document.			
3	S_MPAK	RADIO NET	RADIO NET	signal_status_ok
4	S_MPAK	RADIO_NET	APP_DIR	signal_status_ok
5	masc frame M			
6	S_hook off	AUDIO	AUDIO	signal_status_ok
7	S_hook off	AUDIO	APP_DIR	signal_status_ok
8 - 9	are not handled in this document.			
10	S_hook on	AUDIO	AUDIO	signal_status_ok
11	S_hook on	AUDIO	APP_DIR	signal_status_ok
12 - 13	are not handled in this document			
14	S_MPAK	RADIO_NET	APP_DIR	signal_status_ok
15	masc frame M			

Note: signal 1 - 5 contains MPAK CONREQ
signal 8 - 9 contains MPAK CONREA
signal 12 - 15 contains MPAK DISCON

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Observe that APP_DIR generates MPAK DISCON to unit B.
This is to avoid blocking situations in unit B.

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5 LISTS OF SIGNALS

Signals that are sent within the MCU, interfaces A, B and C in figure 1, are listed below. The signals are divided into categories of normal and returned signals.

5.1 Interface A

5.1.1 Signals sent from APP_DIR to line handlers

Normal signals

S_MPAK

origin = creator of this signal
from = APP_DIR
signal_status = signal_status_ok
signal_type = S_MPAK
MPAK = MPAK in question

S_not_sent_MPAK

origin = creator of original MPAK
from = APP_DIR
signal_status = signal_status_ok
signal_type = S_not_sent_MPAK
MPAK = MPAK in question

S_returned_incorrect_MPAK

origin = creator of original MPAK
from = APP_DIR
signal_status = signal_status_ok
signal_type = S_returned_incorrect_MPAK
MPAK = MPAK in question

S_MPAK_sent_on_radio

origin = creator of original MPAK
from = APP_DIR
signal_status = signal_status_ok
signal_type = S_MPAK_sent_on_radio

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5.1.2 Signals sent from line handlers to APP_DIR

Normal signals

S_line up
Origin = line handler in question
from = origin
signal_status = signal_status_ok
signal_type = S_line_up

S_line down
Origin = line handler in question
from = origin
signal_status = signal_status_ok
signal_type = S_line_down

S_MPAK
origin = line handler in question
from = origin
signal_status = signal_status_ok
signal_type = S_MPAK
MPAK = MPAK in question

Returned signals

S_MPAK
origin = no change in this field
from = line handler in question
signal_status = signal_status_not_sent
signal_type = S_MPAK
MPAK = MPAK in question

S_MPAK_sent_on_radio
Origin = no change in this field
from = line handler in question
signal_status = signal_status_not_sent
signal_type = S_MPAK_sent_on_radio

S_returned_incorrect_MPAK
origin = no change in this field
from = line handler in question
signal_status = signal_status_not_sent
signal_type = S_returned_incorrect_MPAK
MPAK = MPAK in question

S_not_sent_MPAK
origin = no change in this field
from = line handler in question
signal_status = signal_status_not_sent
signal_type = S_not_sent_MPAK
MPAK = MPAK in question

Blockout

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5.1.3 Signals from APP_DIR to AUDIO

All signals listed in 5.1.1.

5.1.4 Signals from AUDIO to APP_DIR

All signals listed in 5.1.2, plus the following:

S_hook off

Origin	=	AUDIO
from	=	AUDIO
signal_status	=	signal_status_ok
signal_type	=	S_hook_off

S_hook on

Origin	=	AUDIO
from	=	AUDIO
signal_status	=	signal_status_ok
signal_type	=	S_hook_on

5.1.5 Signals from APP_DIR to RADIO_NET

Normal signals

S_MPAK

origin	=	creator of this signal
from	=	APP DIR
signal_status	=	signal_status_ok
signal_type	=	S_MPAK
MPAK	=	MPAK in question

S_hook on

Origin	=	AUDIO
from	=	APP DIR
signal_status	=	signal_status_ok
signal_type	=	S_hook_on

S_hook off

Origin	=	AUDIO
from	=	APP DIR
signal_status	=	signal_status_ok
signal_type	=	S_hook_off

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5.1.6 Signals from RADIO_NET to APP_DIR

Normal signals

S_MPAK

origin	=	RADIO_NET
from	=	origin
signal_status	=	signal_status_ok
signal_type	=	S_MPAK
MPAK	=	MPAK in question

Returned signals

S_MPAK

origin	=	no change in this field
from	=	RADIO_NET
signal_status	=	signal_status_not_sent
signal_type	=	S_MPAK
MPAK	=	MPAK in question

S_hook_on

origin	=	AUDIO
from	=	RADIO_NET
signal_status	=	signal_status_not_sent
signal_type	=	S_hook_on

S_hook_off

origin	=	AUDIO
from	=	RADIO_NET
signal_status	=	signal_status_not_sent
signal_type	=	S_hook_off

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6 REGISTERS IN APP_DIR

Four registers are kept in APP_DIR:

6.1 Register number one: MCU_REG

The register called MCU_REG has the structure shown in the figure below.

LINE		MASC1	MASC2	MASC3	AUDIO	PRINTER
MAY / MAY NOT INACTIVATE MCU						
LINE UP / LINE_DOWN						
MSG TYPE	TEXT					
	STATUS					
	DATA					
	HPDATA					
	SPEECH					
	EMERGENCY					
EXTPAK						

line

Contains the line handlers that exist in this application. This is static information.

msg type

Tells which MPAKs, addressed to MCU MAN or any MAN in the group list, will be received by the line handler. As an example, there is nothing to prevent that MPAK TEXT is received by a number of line handlers. In the speech connection case, in this particular application, only one line handler can be enabled. Msg type contains static information.

may/may not inactivate MCU

Tells whether the line handler in question is allowed to inactivate MCU with an MPAK DTESERV.INACTIVE. Normally, only one (or very few) of the line handlers should be allowed to do this. This is static information.

Baudrate

Baudrate

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line up/down

Contains information about each of the connected line handlers. This information is dynamic.

The figure below shows how the MCU_REG may be used.

LINE		MASC1	MASC2	MASC3	AUDIO	PRINTER
MAY / MAY NOT INACTIVATE MCU		MAY	NOT	NOT	NOT	NOT
LINE UP / LINE DOWN		UP	UP	DOWN	UP	UP
MSG TYPE	TEXT	X	X	X		X
	STATUS				X	
	DATA	X				
	HPDATA	X				
	SPEECH	X				
	EMERGENCY	X				
	EXTPAK	X				

In this case, only MASC1 is allowed to inactivate the MCU. All line handlers, except for MASC3, are connected and intact. When APP DIR receives an MPAK TEXT from MOBITEK network, it will be sent to MASC1, MASC2 and PRINTER. Since MASC3 does not have status line up, it does not receive any MPAKs. Received MPAK STATUS is to be sent to AUDIO. Other MPAKs are to be sent to MASC1.

Observe that APP DIR does not keep information of if MCU is active or inactive. Nor does APP DIR know if RADIO NET has received an MPAK DIE from the MOBITEK network. It is the responsibility of RADIO NET to keep information about this. If RADIO NET notes which APP DIR is not allowed to send to the MOBITEK network, the packets are returned to APP DIR with signal status set to signal_status_not_sent.

Backup

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6.2 Register number two: FLEXLIST

The FLEXLIST register has the structure shown in the figure below.

MAN	LINE	STATUS

MAN - The MOBITEK subscription number of the transferred subscriber. Up to seven MAN-numbers are allowed.

LINE - The line handler to which the transferable has transferred..

STATUS - Tells login status.
 It can be: **UNDER_LOGIN** - the login sequence is not yet finished
OK_LOGIN - the login sequence is finished and accepted

6.3 Register number three: GROUPLIST

The GROUPLIST contains a list of group MAN numbers. Up to 15 MAN numbers is allowed.

6.4 Register number four: CONNECTION_REG

CONNECTION_REG keeps information about the status of the speech line. It contains the following information:

CONNECTION_STATUS - can be free, busy or waiting_for_hook_off

CONNECTION_PARTY_HERE - MAN number for connection part in the MCU

CONNECTION_OTHER_PARTY - MAN number for the other connection part

CONNECTION_CONN_ID - connection identity for current speech line connection

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7 REQUIREMENTS ON THE NETWORK LAYER IN MCU

Requirements on the network layer in MCU (RADIO_NET) are listed below:

1. Everything applicable to mobile terminal in document MOBITEK network layer for terminals, 5/1056 - A 296 5171.
2. All MPAKS that the application wants to send via radio and network layer to
 - be acknowledged to the application if the transmission was successful,
 - be returned to the application if the transmission failed.
3. The signals hook on and hook off will be returned to the application if the transmission via radio fails.
4. The following MPAKS, received by the MCU via radio, to be sent to the application:
 - all MPAKS of class PSUBCOM
 - all MPAKS of class PSOSCOM.
Note that a transferred subscriber, connected to the MCU via an MASC handler, can be emergency receiver.
 - following MPAKS, belonging to the class CSUBSOM:
 - + CONREQ
 - + ADDCONREQ
 - + SOSCONREQ
 - + EXTCONREQ
 - + CONORD
 - + DISCON
 - following MPAKS, belonging to the class DTESERV:
 - + LOGINREQ * **
 - + LOGINREF * **
 - + LOGOUTORD * **
 - + LOGINGRA * **
 - + FLEXLIST * **
 - + TIME * **
 - + GROUPLIST * **
 - + SOSRX * ***
 - + VICESOSRX * ***

- * These MPAKS can only have MPAK states that are not OK.
- ** These MPAKS concern flexlist and grouplist. They are handled by the network layer and sent to the application. The reason for this is that the application has copies of flexlist and grouplist.
- *** Only if a terminal, connected to the MCU, has an emergency receiver transferred to it.

Subnet:

Region:

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8 REQUIREMENTS ON A FIXED TERMINAL

The requirements for a fixed terminal which is able to connect to the MOBITEK network as well as the MCU are as follows.

Link layer

Frames in the masc protocol for implemented:

All control frames : ACK, RACK, NACK, SENS, SACK

Following information frames:

B, M, E, R, F_P, F_Q, N

Network layer

The MOBITEK network considers a fixed terminal, connected via an MCU, as a mobile terminal. This has the following consequences as to which MPAKs may be sent and received by the terminal.

class PSUBCOM:

The terminal is allowed to send and receive all MPAKs in this class.

class PSOSCOM:

An emergency sender can be a mobile subscriber or a transferable subscriber which is transferred to a mobile subscriber. A receiver can be a fixed terminal subscriber or a transferable subscriber. All emergency senders can send SOS and receive SOSACK. Furthermore, all mobile terminals are able to receive SOS and SOSACK addressed to All terminals group MAN.

class CSUBCOM:

If the fixed terminal has one line for speech line connection, the following MPAKs can be received and sent:

CONREQ
SOSCONREQ
ADDCONREQ
EXTCONREQ
CONREA
DISCON

Connection to group will be made by the MCU by converting CONORD to CONREQ.

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class DTESERV:

Following MPAKs may be sent:

LOGINREQ
LOGOUT
ACTIVE
INACTIVE
VICESOSRX
SOSRX
FLEXLIST

*
*

* Only if the sender is a transferable subscriber.

Following MPAKs shall be received:

LOGINREQ
LOGINRA
LOGINREF
LOGOUTORD
VICESOSRX
SOSRX
GROUPLIST
FLEXREQ
TIME

When the network layer receives masc frame N from the masc interface, it acts in the same manner as if the MPAK never leaved the fixed terminal.

Bidder

Buyer

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9 PSEUDO CODE FOR APP_DIR

In this pseudo code all procedures start with "P_", and all functions with "F_".

REPEAT

```
Wait for input
CASE input signal type OF
  S_MPAK sent on radio
    IF from = RADIO NET THEN
      send this signal to origin
    ELSE
      forget this signal
    END IF
  S_hook on
  P_hook on
  S_hook off
  P_hook off
  S_line up
  P_line up
  S_line down
  P_line down
  S_MPAK
  P_MPAK
  conOrd timer
  CONNECTION_STATUS = free
otherwise
  forget this signal
END CASE input signal OF
UNTIL forever
```

P_hook on

```
IF ( from = AUDIO ) AND ( CONNECTION_STATUS <> free )
THEN
  send this signal to RADIO NET
  send signal S_MPAK with MPAK = DISCON to
  CONNECTION LINE
  (MPAK.sender = CONNECTION OTHER PARTY
  MPAK.addressee = CONNECTION PARTY HERE
  MPAK.type dependent.line number = 0
  MPAK.type dependent.CONN_ID=CONNECTION_CONN_ID)
  CONNECTION_STATUS = free
ELSE
  forget this signal
END IF (from = AUDIO) AND (CONNECTION_STATUS <>free)...
END P_hook on
```

Bitstream

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```

P_hook_off
  IF from = AUDIO THEN
    IF CONNECTION_STATUS = waiting_for_hook_off THEN
      CONNECTION_STATUS = busy
      send this signal to RADIO_NET
      reset conord_timer
    ELSE
      forget this signal
    END IF CONNECTION_STATUS = waiting_for_hook_off...
  ELSE
    IF (from=RADIO_NET) AND (signal_status =
                                signal_status_not_sent) THEN
      forget this signal
      send signal S MPAK with MPAK = DISCON to
      CONNECTION LINE
      ( MPAK.sender = CONNECTION OTHER PARTY
        MPAK.addressee = CONNECTION PARTY HERE
        MPAK.type_dependent.line number = 0
        MPAK.type_dependent.CONN_ID = CONNECTION_CONN_ID )
      CONNECTION_STATUS = free
    ELSE
      forget this signal
    END IF (from = RADIO_NET) AND (signal_status =...)
  END IF from = AUDIO...
END P_hook_off

```

```

P_line_down
  mark origin in MCU REG as line down
  FOR all MAN in our flexlist pointing at origin DO
    send signal S MPAK with MPAK = logout to RADIO NET
    ( MPAK.sender = MAN in question from flexlist
      MPAK.addressee = the MOBITEX network
      MPAK.type dependent part = MCU MAN )
    remove MAN in question from our flexlist
  END FOR all MAN in our flexlist pointing...
END P_line_down

```

```

P_line_up
  send signal S MPAK with MPAK = grouplist to origin
  ( MPAK.sender = the MOBITEX network
    MPAK.addressee = MCU MAN
    MPAK.type dependent part = our grouplist )
  send signal S MPAK with MPAK = flexreq to origin
  ( MPAK.sender = the MOBITEX network
    MPAK.addressee = MCU MAN )
  mark origin in MCU REG as line_up
END P_line_up

```

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```

P_MPAK
  IF signal_status = signal_status_ok THEN
    IF from = RADIO_NET THEN
      P_MPAK_from_radio
    ELSE
      P_MPAK_from_other
    END IF from = RADIO_NET...
  ELSE
    IF origin = from THEN
      forget this signal (can't send this signal in any
        direction )
    ELSE
      IF origin = RADIO_NET THEN
        forget this signal (Never send back MPAK to
          network)
      ELSE
        IF MPAK.unknown_f = 0 THEN
          CASE MPAK.packet_class OF
            PSUBCOM,PSOSCOM
              signal_status = signal_status_ok
              signal_type = S_not_sent_MPAK
              send this signal to origin
            CSUBCOM
              CASE MPAK.packet_type OF
                CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ
                  signal_status = signal_status_ok
                  signal_type = S_not_sent_MPAK
                  send this signal to origin
                  CONNECTION_STATUS = free
                otherwise
                  forget this signal
              END CASE MPAK.packet_type...
            DTESERV
              CASE MPAK.packet_type OF
                VICESOSRX,SOSRX
                  signal_status = signal_status_ok
                  signal_type = S_not_sent_MPAK
                  send this signal to origin
                LOGINREQ
                  remove MPAK.type_dependent_part from our
                    flexlist
                  signal_status = signal_status_ok
                  signal_type = S_not_sent_MPAK
                  send this signal to origin
                otherwise
                  forget this signal
              END CASE MPAK.packet_type...
            END CASE MPAK.class...
          ELSE
            forget this signal
          END IF MPAK.unknown_f.
        END IF origin...
      END IF origin...
    END IF signal_status...
  END P_MPAK

```

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```

P_MPAK_from_other
mark origin in MCU REG as line_up
CASE MPAK.packet_class OF
PSUBCOM,PSOSCOM
IF MPAK.unknown f = 1 THEN
IF (F_get_receiver_MAN in our grouplist ) OR
(F_get_receiver_MAN = MCU_MAN ) THEN
forget this signal
ELSE
IF F_get_receiver_MAN in our flexlist THEN
remove F_get_receiver_MAN from our flexlist
send signal S_MPAK with MPAK = LOGOUT to RADIO_NET
(MPAK.sender = F_get_receiver_MAN
MPAK.addressee = the MOBITEK network
MPAK.type_dependent_part = MCU_MAN )
END IF F_get_receiver_MAN in our flexlist
send this signal to RADIO_NET
END IF (F_get_receiver_MAN in our grouplist...)
ELSE ( IF MPAK.unknown f = 1 ...)
IF (MPAK.state <> OK ) OR ( MPAK.digital f = 1 ) THEN
signal_type = S_returned_incorrect_MPAK
send this signal to origin
ELSE
IF (F_get_transmitting_MAN = MCU_MAN ) or
(F_get_transmitting_man in our flexlist with status
ok_login ) THEN
send this signal to RADIO_NET
ELSE
send signal S_MPAK with MPAK = LOGOUTORD to origin
(MPAK.sender = the MOBITEK network
MPAK.addressee = MCU_MAN
MPAK.type_dependent_part= F_get_transmitting_MAN)
signal_type = S_not_sent_MPAK
signal_status = signal_status_ok
send this signal to origin
END IF (F_get_transmitting_MAN = MCU_MAN...)
END IF MPAK.state...
CSUBCOM
CASE MPAK.packet_type OF
CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ
IF ( MPAK.unknown f = 0 ) and
( MPAK.mailbox f = 0 ) and
( MPAK.sendlist f = 0 ) and
( mpak.state = OK ) THEN
IF (F_get_transmitting_MAN = MCU_MAN ) or
(F_get_transmitting_MAN is in our flexlist with
status ok_login )
THEN
IF CONNECTION STATUS = free THEN
CONNECTION_line = origin
CONNECTION_status = busy
send this signal to RADIO_NET

```

Endnote

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ELSE
  signal_type = S_not_sent_MPAK
  signal_status = signal_status_ok
  send this signal to origin
END IF 'CONNECTION_STATUS = free...'
ELSE
  send signal S_MPAK with MPAK = LOGOUTORD to
  origin
  ( MPAK.sender = the MOBITEK network
    MPAK.addressee = MCU MAN
    MPAK.type dependent Part =
      F_get transmitting_MAN )
  signal_type = S_not_sent_MPAK
  signal_status = signal_status_ok
  send this signal to origin
  END IF (F_get_transmitting_MAN = MCU_MAN...)
ELSE
  signal_type = S_returned_incorrect_MPAK
  send this signal to origin
END IF ( MPAK.unknown_f = 0...
CONREA
IF ( CONNECTION_STATUS = waiting_for_hook_off) and
( origin = CONNECTION_line ) THEN
  forget this signal
  send signal S hook off to RADIO_NET
  CONNECTION_STATUS = busy
  reset conord_timer
ELSE
  forget this signal
DISCON
IF ( CONNECTION_STATUS <> free) and
( origin = CONNECTION_line ) THEN
  forget this signal
  send signal hook on to RADIO_NET
  CONNECTION_STATUS = free
ELSE
  forget this signal
otherwise
  forget this signal
END CASE MPAK.packet_type...
DTESERV
CASE MPAK.packet_type OF
  LOGINREQ,LOGOUT,ACTIVE,INACTIVE,VICESOSRX,SOSRX,FLEXLIST
  IF (MPAK.state = ok ) AND
  ( MPAK.digital_f = 0 ) AND
  ( MPAK.mailbox_f = 0 ) AND
  ( MPAK.sendlist_f = 0 ) AND
  ( MPAK.unknown_f = 0 ) AND
  ( MPAK.extern_f = 0 ) AND
  ( MPAK.addressee = MOBITEK_network ) THEN
  CASE MPAK.packet_type OF
    LOGINREQ,ACTIVE,INACTIVE,FLEXLIST
    IF MPAK.sender = MCU_MAN THEN
      CASE MPAK.packet_type OF

```

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LOGINREQ
IF MPAK.type_dependent_part in our flexlist
with status = ok login THEN
send signal S_MPAK with MPAK LOGINGRA to
origin
( MPAK.sender = the MOBITEK network
MPAK.addressee = MCU MAN
MPAK.type_dependent_part =
=<old>MPAK.type_dependent_part )
forget this signal
ELSE
IF more space exists in our flexlist THEN
mark MPAK.type_dependent_part in our
flexlist
with status=under_login and line =
origin
send this signal to RADIO_NET
ELSE
signal_type = S_not_sent_MPAK
signal_status = signal_status_ok
--send this signal to origin
END IF more space in our flexlist...
END IF MPAK.type_dependent_part in our...
ACTIVE, INACTIVE
IF origin may inactivate THEN
P line down
send this signal to RADIO_NET
ELSE
P line down
forget this signal
END IF origin may activate/inactivate...
FLEXLIST
FOR all MAN in MPAK.FLEXLIST not in our
flexlist
with status ok login DO
send signal S_MPAK with MPAK = logoutord
to origin
( MPAK.sender = the MOBITEK network
MPAK.addressee = MCU MAN
MPAK.type_dependent_part = MAN in
question )
END FOR all MAN in MPAK.FLEXLIST not in our...
forget this signal
END CASE MPAK.packet_type
ELSE ( IF MPAK.sender = MCU MAN)
signal_type = S_returned_incorrect_MPAK
send this signal to origin
END IF MPAK.sender = MCU MAN...

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VICESOSRX,SOSRX
IF MPAK.sender in our flexlist with status
ok_login THEN
  send this signal to RADIO_NET
ELSE
  signal_type = $ not_sent MPAK
  signal_status = signal_status_ok
  send this signal to origin from
END IF MPAK.sender in our flexlist with status...
LOCOUT
IF MPAK.sender in our flexlist with any status
THEN
  delete MPAK.sender from our flexlist
  MPAK.type_dependent_part = MCU MAN
  send this signal to RADIO_NET
ELSE
  forget this signal
END IF MPAK.sender in our flexlist ...
END CASE MPAK.packet_type...
ELSE
  signal_type = $ returned incorrect_MPAK
  send this signal to origin
END IF (MPAK.state = ok...
otherwise
  signal_type = $ returned incorrect_MPAK
  send this signal to origin
END CASE MPAK.packet_type...
END CASE MPAK.class...
END P_MPAK_from_other

```

```

P_MPAK from radio
CASE MPAK.class OF
  PSUBCOM,PSOSCOM
    IF F_get receiver MAN in our flexlist THEN
      send this signal to line in question
    ELSE
      IF ( F_get receiver MAN = MCU MAN ) OR
      ( F_get receiver MAN in our groupelist ) THEN
        CASE MPAK.class OF
          PSUBCOM
            CASE MPAK.packet_type OF
              TEXT
                P copy_and_send_signal( text )
              STATUS
                P copy_and_send_signal( status )
              HPDATA
                P copy_and_send_signal( hpdata )
              DATA
                P copy_and_send_signal( data )
              EXTPAK
                P copy_and_send_signal( EXTPAK )
            otherwise
              forget this signal
          END CASE MPAK.packet_type...

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PSOSCOM
IF ( MPAK.packet_type = SOS or SOSINFO )
AND ( MPAK.addressee = all terminal group MAN )
THEN
  IF MPAK.sender in out flexlist THEN
    send this signal to line in question
  ELSE
    P_copy_and_send_signal( emergency )
  END IF MPAK.sender in our flexlist...
ELSE
  P_copy_and_send_signal( emergency )
END IF ( MPAK.packet_type = SOS or SOSINFO...
END CASE MPAK.class...
ELSE
  ( This case can not appear; the network layer shall
  take care of unknown MPAKs from the network)
  MPAK.unknown_f = 1
  send this signal to RADIO_NET
  END IF ( F_get_receiver_MAN = MCU MAN...
  END IF F_get_receiver_MAN in our flexlist...
CSUBCOM
CASE MPAK.packet type OF
  CONREQ,ADDCONREQ,SOSCONREQ,EXTCONREQ
  IF MPAK.state <> ok THEN
    P_discon
  ELSE
    IF F_get_receiver_MAN in our flexlist THEN
      CONNECTION STATUS = waiting_for_hook_off
      CONNECTION_LINE = line in question from flexlist
      CONNECTION_PARTY HERE = MPAK.addressee
      CONNECTION_OTHER_PARTY = MPAK.sender
      CONNECTION_CONN_ID =MPAK.type_dependent.conn_id
      send this signal to line in question
    ELSE
      IF F_get_receiver_MAN = MCU MAN THEN
        CONNECTION STATUS = waiting_for_hook_off
        CONNECTION_PARTY HERE = MPAK.addressee
        CONNECTION_OTHER_PARTY = MPAK.sender
        CONNECTION_CONN_ID =MPAK.type_dependent.conn_id
        send this signal to first line in MCU_REG with
        (line_status = up) AND (msg_type = speech)
        IF no such line THEN
          forget this signal
          CONNECTION STATUS = waiting_for_hook_off
          send signal S_hook_on to RADIO_NET
        ELSE
          CONNECTION_LINE = line in question from
          MCU_REG
        END
      ELSE
        forget this signal
        send signal S_hook_on to RADIO_NET
      END IF ( F_get_receiver_MAN = MCU MAN...
    END IF F_GET_receiver_MAN in our flexlist...
  END IF MPAK.state <> ok

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CONORD
  IF CONNECTION STATUS = free THEN
    IF F_get_receiver MAN in our grouplist THEN
      MPAK.packet_type = CONREQ
      CONNECTION STATUS = waiting for hook off
      CONNECTION_PARTY_HERE = MPAK.addressee
      CONNECTION_OTHER_PARTY = MPAK.sender
      CONNECTION_CONN_ID = MPAK.type_dependent.conn_id
      send this signal to first line in MCU_REG with
      ( line_status = up ) AND ( msg_type = speech )
      IF no such line THEN
        forget this signal
        CONNECTION STATUS = free
        send signal S_hook_on to RADIO_NET
      ELSE
        CONNECTION_LINE = line in question from MCU_REG

        set timer: conord_timer
      END
    ELSE
      forget this signal
      send signal S_hook_on to RADIO_NET
    END IF F_get_receiver MAN in our grouplist...
  ELSE
    forget this signal
  END IF CONNECTION STATUS = free...
DISCON
  P_discon
  otherwise
    forget this signal
  END CASE MPAK.packet_type...
DTESERV
CASE MPAK.packet_type OF
  LOGINREQ, LOGINREF, LOGOUTORD
    IF MPAK.type_dependent in our flexlist THEN
      send this signal to line IN QUESTION
      remove MAN in question from our flexlist
    ELSE
      forget this signal
    END IF MPAK.type_dependent in our flexlist THEN
  LOGINGRA
    IF MPAK.type_dependent in our flexlist THEN
      mark in our flexlist status = ok login
      send this signal to line in question
    ELSE
      send signal S_MPAK with MPAK = logout to RADIO_NET
      ( MPAK.sender = MCU MAN
        MPAK.addressee = MOBITEK network
        MPAK.type_dependent_part = MAN in question
      )
    END IF MPAK.type_dependent in our flexlist ....

```

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FLEXLIST
FOR all MAN in this signal who are not in our flexlist
  send signal S_MPAK with MPAK = logout to RADIO_NET
  ( MPAK.sender = MCU MAN
    MPAK.addressee = MOBITEK network
    MPAK.type_dependent_part = MAN in question )
END
FOR all MAN in our flexlist who are not in this signal
  send signal S_MPAK with MPAK = logoutord to line in
  question
  ( MPAK.sender = MOBITEK network
    MPAK.addressee = MCU MAN
    MPAK.type_dependent_part = MAN in question )
  remove MAN in question from our flexlist
END
TIME
  send a copy of this signal to all lines
GROUPLIST
  store grouplist from this signal in our register
  send a copy of this signal to all lines
SOSRX,VICESOSRX
  IF F_get receiver MAN in our flexlist THEN
    send this signal to line in question
  ELSE forget this signal
  END CASE MPAK.packet_type OF...
  END CASE MPAK.class...
END P_MPAK_from_radio

P_copy_and_send_signal( type )
  send a copy to all lines in MCU_REG with
  ( line status = up ) and ( msg_type = type )
END P_copy_and_send_signal

P_discon
  IF CONNECTION_STATUS <> free
    send this signal to CONNECTION_LINE
    CONNECTION_STATUS = free
  ELSE
    forget this signal
  END
END P_discon

```

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F_get receiver_MAN
CASE MPAK.state OF
  ok, from mail
    F_get_receiver_MAN = MPAK.sender
  otherwise
    F_get_receiver_MAN = MPAK.addressee
END CASE
END F_get_receiver_MAN

F_get transmitting_MAN
IF MPAK.unknown_F = 0 THEN
  F_get_transmitting_MAN = MPAK.sender
ELSE
  F_get_transmitting_MAN = F_get_receiver_MAN
END
END F_get_transmitting_MAN
  
```

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10 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-09, 3
 R1-16, 3

Below are the reference designations listed.

<u>Reference</u>	<u>Section</u>
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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Bezeichnet

REQUIREMENT SPECIFICATION 1(9)

Uppdrag: ET/SYS PES Uppdragsgivare: ET/SYS PES Uppdragsnummer: ET/SYSC STT 577	Uppdragsnamn: ET/SYS PES Uppdragsdatum: 1990-02-26 A Uppdragsstatus: A Uppdragsversion: MTS20.2	Nr: 1056 - A 296 5177/02 Ue Datum: 1990-02-26 A Författare: MTS20.2 Titel: MOBITEK Beskrivning: General requirements, mobile term.
<h2 style="text-align: center;">Cantel Mobitex</h2>		
<p>SUMMARY</p> <p>The general requirements for MOBITEK mobile terminals are described in this document. These include environmental requirements, power supply requirements, the minimum requirements for controls and indicators and special requirements in connection with the type approval testing.</p>		

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Subject

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No. 1056 - A 296 5177/02 Ue
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1 ENVIRONMENTAL REQUIREMENTS

The equipment must be operational also under the extreme temperature conditions. No error functions which can interfere with the operation of the MOBITEK network must occur under any environmental condition.

1.1 Temperature

The normal operational temperature range:

+15 to +35 degrees C.

The extreme operational temperature range:

-25 to +55 degrees C.

The equipment should be such that it is not damaged by storage in the temperature range of:

-40 to +70 degrees C.

1.2 Relative humidity

Mobil terminal should be able to withstand 20-75% RH.

1.3 Vibrations

The equipment should be able to withstand a vibration test in accordance with IEC publication 68-2-6:

10 - 55 Hz +/- 0,15 mm movement.

55 - 150 Hz 20 m/s square acceleration.

Sweep rate: 1 octave per minute

Duration: 2 hours in each of the three directions.

The equipment should not be in operation during the test but should comply with the requirements in the MOBITEK terminal specification after the test.

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2.1 Nominal voltage

2.2 Voltage limits

Equipment designed for operating on an alternating voltage should comply with the specifications when the voltage varies by $\pm 10\%$.

If these limiting values are exceeded, error functions which can interfere with the operation of the network should not occur.

3 MARKING

The equipment should be clearly marked with the manufacturer, type designation, serial number, approving text ("Approved by ...") and registration number of the type approval. The marking should be engraved on metal and permanently fixed to the equipment.

The mobile terminal's subscription number should be clearly visible or accessible.

3.1 Electronic serial number check

The serial number should be stored together with the terminal subscription MAN and permanently in such a way that they are impossible to change by software or by unauthorised persons, preferably in encrypted form.

The serial number of the equipment should be checked in the terminal against the serial number stored together with the MAN at power on. If the numbers are not equal, it should be impossible to use the equipment.

In addition, the serial number (ESN) is sent to the network at "activation", to be checked with the serial number stored in the network (see reference R1-09).

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4 CONTROLS

There are no requirements for type approval of controls. There are certain recommendations however.

If number keys for number keying are used, they should comply with one of the following minimum configurations.

1	2	3	4	5	*	A	B
6	7	8	9	0	#	C	D

1	2	1	2	3	A
3	4	4	5	6	B
5	6	7	8	9	C
7	8	*	0	#	D
9	0				
*	#				
A	B				
C	D				

The following recommendations apply for the A, B, C and D keys. The D key should have the data send function. If there is a speech facility, key C is used for "speech request". The key should be marked with T. Keys A and B can be used for status or another function and marked according to use.

International standards should be followed if a completely alphanumeric keyboard is used. The number keys on the keyboard can then be used for number keying as well.

5 INDICATORS

An indicator with yellow or amber colour should indicate when the power is switched on.

An indicator with green colour should indicate with a steady light when the mobile terminal is in contact with the MOBITEK network and with a twinkling light when it is not (base search mode).

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6 TYPE APPROVAL TESTING

Except the equipment described in the chapters below, requirements may be specified by the network operator (please refer to reference RI-06) for equipment such as:

- Portable antennas
- Cabling and terminations
- Terminal display

6.1 Equipment to be type approved

The type approval test applies to the radio equipment and to the physical, link and network layers of the mobile equipment according to these specifications. Application layer functions are only tested if under special requirements when installed.

The type approval only applies to the software tested. If a change is made in any software stored in the same storage unit as the software handling the tested functions, a new type test must be made. The testing authority should determine at its discretion and based on documentation of the modifications, whether new measurements are necessary for a new approval.

Optional terminal equipment to be connected to the radio control unit is not type tested.

6.2 Normal test conditions

The mobile terminal should be tested in the normal environment stated above. The specified data should be complied with for all combinations.

Terminals designed for operating on lead acid accumulators in vehicles should be tested at 1.0 times the nominal voltage.

The terminal should be ready for operation within 1 minute of switching on the power.

6.3 Extreme test conditions

Additional environmental requirements can be made in reference RI-06 (Network operator information).

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The mobile unit should be tested at the lower and upper limits in the temperature and voltage ranges stated above.

Before testing is carried out, the equipment should have achieved thermal equilibrium in the test chamber. The power supply should be switched off during this period. Measurements should be carried out in such a sequence and with relative humidity controlled so that excessive condensation does not occur.

Testing at the upper temperature limit should begin with the sender in the send position for 1 minute and receiving for 4 minutes after which measurements are carried out.

Testing at the lower temperature limit should commence 1 minute after switching on the power supply.

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6.4 Test connections, interfaces and controls

For the type approval test, the mobile terminal should be equipped with test connections and manual controls to permit the measurements that are necessary to verify that the specification requirements are complied with. This applies particularly to the requirements stated in reference R1-18 ("Radio equipment, mobile terminals" and "Measurement methods"). These connections and controls can be implemented by external test adaptors during the test.

For the type approval test, the equipment should also be equipped with the "Machine interface (MASC)" as described in reference R1-19 ("Other interfaces, mobile terminal", minimum basic and type test functions). This interface can be implemented by an external test adaptor during the test.

Equipment intended to be used as partially active in MOBITEK should be possible to operate as a normal mobile terminal during the tests, i.e. continuously listening to MOBITEK.

Submitt

Approved

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7 MOBITEK TERMINAL SPECIFICATION REFERENCE LIST

This document includes a number of references, made to other sections in the terminal specification. The list below shows these references, together with the page(s) they are made on. Please note that a section could be referred to several times on the same page.

R1-06, 6
R1-09, 4
R1-18, 8
R1-19, 8

Below are the reference designations listed.

Reference	Section
R1-01	Arrangement of the documents
R1-02	MOBITEK System description
R1-03	General description of terminals
R1-04	Terminology
R1-05	References
R1-06	Network operator information
R1-08	Application layer
R1-09	Network layer
R1-11	Interface requirements, fixed terminals
R1-12	Other requirements, fixed terminals
R1-16	Link layer, mobile terminals
R1-17	Physical layer, mobile terminals
R1-18	Radio equipment, mobile terminals
R1-19	Other interfaces, mobile terminals
R1-20	Other requirements, mobile terminals

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